The new Attractiue.

Containing a Short Diſcourſe of the *Magnes* or Loadſtone: and amongſt other his vertues, of a new diſcouered ſecret and ſubtill propertie, concerning the declination of the *Needle*, touched therewith vnder the plaine of *the Horizon*.

Now firſt founde out by *Robert Norman*. Hydrographer.

HEEREVNTO ARE ANNEXED CERtaine neceſſary rules for the Arte of Nauigation: by the ſame R.N.

Newly corrected and amended by M.W.R.

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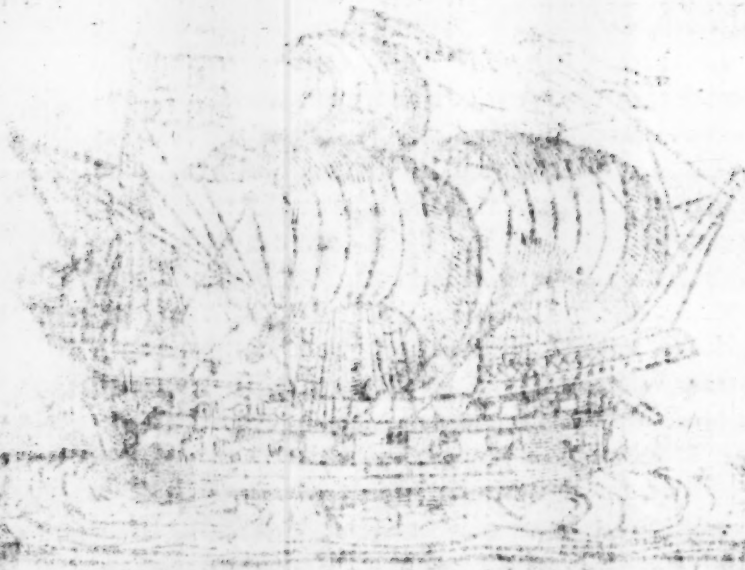


TO THE RIGHT WORSHIPFVLL, M. WILLIAM BOrough Esquire, Comptroller of her Maiesties Nauie: *Robert Norman* wisheth increase of worshippe, in perfecte felicitie.

ARchimedes, after long search made to finde out the fraudulent myxture of King Hierons golden Crowne: could not by any meanes attaine the secrete thereof, till at length by chaunce as he was Bathing himself, he obserued that still as his body entred into the water, it forced the same to ryse and runne ouer the Vessell: wherupon the matter of the Crowne comming to hys remembrance, and applying the manner of the water to his present purpose, hee was foorthwith mooued with suche exceeding ioy, that hee leapt so dainlye out of the water, and forgetting him selfe to bee naked, came crying to the King his Maister, I haue founde, I haue founde: So I (right Worshipfull, although in other respectes & points of learning and knowledge, I will not presume to compare with *Archimedes*, who is many waies incomparable, nor with any other learned Mathematician, being my selfe an vnlearned Mathematician) by occasion of my profession, making sundry experimentes of the *Magnes* stone, founde at length amongst many other effectes, this strange and newe propertie of Declining of the Needle: which forgetting, or rather neglecting mine owne nakednesse and want of furniture to set foorth the matter, I haue heere in simple forte proposed and published to the viewe of the

world. Wherein I consider, though the occasions were diuers, our cases are not vnlike. *Pithagoras* lykewyse that greate Philosopher, for the singular ioy conceiued of the invention of that excellente Theoreme of Rectangle Triangles, made a solempne sacrafice, offering therein an Oxe vnto the Muses, as testifieth *Vitrunius* the author also of the former example. So that wee see these men and sundry others that are mentioned in authors, being caried and ouercome wyth the incredible delight conceiued of their owne deuices and inuentions, though they followe partly the peculiar contentation of their priuat fancies, yet they seme chiefly to respect either the glorie of God or the furtheraunce of some publike commoditie. Whose good example in this behalfe I will indeuour to followe, when to reach their rare giftes otherwyse, is rather to bee wished, then hoped for. And seeyng it hath pleased God to make mee the instrument to open thys Noble secret, that his name might be glorified, and the commoditie of my Country procured therby, I thought it my duty to aduenture my credite, and make my name the obiect of slaunderous and carping tongues, rather then suche a secrete shoulde be concealed, and the vse thereof vnknowen.

Howe beneficiall the Arte and exercise of Nauigation is to this Realme, there is no man so simple but sees, by meanes whereof wee beeing secluded and diuided from the rest of the worlde, are notwithstanding, as it were Cittizens of the worlde, walking through euerie corner, and rounde about the same, and enioying all the commodities of the worlde. How necessary the perfecte knowledge of the Needle or compasse is, to the perfection of the Art of Nauigation, your selfe who haue long time verie industriously trauailed therein and thereby in it, and other Sea causes excell others, can best iudge. To attaine vnto thys perfection, and to frame, as it were, a Theorike, wyth *Hypotheses*, and rules for the saluing of the apparant irregularitie of the Variation (if it bee a thing possible or within the compasse of mans capacitie) it must doubtlesse bee done by due obseruation of this new declining propertie,

wyth

with the Variation cauſed by the Admirable efficacie of the *Magnes* ſtone. Wherefore to further the Noble ſtudye of Nauigation and Hydrography, and to giue occaſion to induſtrious & skilful trauailers by ſea and by land, to make diligẽt obſeruation of theſe effects in ſundry places, wherby ſome generall concluſion may be inferred, I haue heere ſet downe whatſoeuer I could finde by exact tryall, and perfect experiments, & beſides this new property, diuers other rare effectes that followe this Philoſophicall ſtone. Wherein although I may ſeeme to haue diſcouered my nakednesſe, and want of eloquence and orderly Methode to vtter my conceites withall, I truſt the reader will either of his curteſie take all thinges for good that is well ment, or of his grauitie not regarding the wordes but the matter, diſſemble my faultes, and accept of my paines. And whereas amongſt diuers learned and expert men in the Mathematicall ſciences, to whome I haue imparted thys ſecret, I haue firſt of all and chiefly from time to tyme ſhewed the manner of it o your Worſhippe, which firſt gaue occaſion that I fell into the conſideration thereof, and through whoſe encouragement I entred into farther examination of the matter, which otherwiſe I had neglected: If my trauell heerein take ſuch effecte, that others be benefited or pleaſured thereby, I haue my deſire, and they are to be thankfull vnto you for the ſame, for I muſt needs aſcribe the occaſion to your good counſaile. To you therefore as to the moſt worthy and beſt acquainted wyth the cauſe, I preſent the firſt ſight of this my rude and ſimple draught, which I truſt, according to your accuſtomed curteſie and friendly affection towardes me, you will take in as good parte, as it proceedes from a harty good will towards you, whom I pray God long to preſerue with all increaſe of Worſhip to his good pleaſure.

Your Worſhips moſt humble, Robert Norman.

To the Reader.

MAny and diuers ancient Authors, Philosophers & others, haue written of the Magnes or Loadstone, as also of the substaunce, vertue and operation, and thereupon setting downe their opinions and iudgementes, haue lefte the same as infallible truthes for them that shall succeede. And as I may not, nor meane not herein willingly to condemne the learned or ancient writers, that haue with great diligence laboured to discouer the secrets of Nature in sundrie things, with their operations & causes: yet I meane God willing, without derogating from them, or exalting my selfe, to set dawne a late experimented truth found in this stone, contrarie to the opinions of all them that haue heeretofore written therof. Wherein I meane not to vse barely, tedious coniectures or imaginations: but breefly as I may, to passe it ouer, grounding my Arguments onely vpon experience, reason and demonstration, which are the greunds of Arts. And albeit, it may be said by the learned in the Mathematicalles, as hath beene already written by some, that this is no question or matter for a Mechanitian or Mariner to meddle with, no more then is the finding of the longitude, for that it must bee handled exquisitelye by Geometricall demonstration, and Arithmeticall Calculation: in which Artes, they would haue all Mechanitians and Sea-men to be ignorant, or at leaste insufficientlie furnished to performe such a matter, alleadging against them the Latine

Prouerbe

Prouerbe of Apelles, *Ne sutor vltra crepidam.* But I doe verily thinke, that notwithstanding the learned in those Sciences, being in their studies amongst their bookes, can imagine greate matters, and sette downe their farre fetcht conceites, in faire showe, and with plawsible wordes wishing that all Mechanicians were such as for want of vtterance, should be forced to deliuer vnto them their knowledge and conceites, that they might flourishe vppon them, and applye them at their pleasures: yet there are in this land, diuers Mechanicians, that in their seuerall faculties and professions, haue the vse of those Artes at their fingers endes, and can apply them to their seuerall purposes, as effectually and more readily then those that would most condemne them. For albeit they haue not the vse of the Greeke and Latin tongues, to search the varietie of Authors in those Artes, yet they haue in English for Geometrie, Euclides Elementes, with absolute demonstrations: and for Arithmaticke, Records workes, both his first and seconde parts: and diuers others, both in English, and in other vulgar languages, that haue also written of them, whych bookes are sufficient to the industrious Mechanician, to make him perfect and ready in those sciences, but especially to apply the same to the Art and faculty which he chiefly professeth. And therefore I woulde wish the learned to vse modestie in publishing their conceites, and not disdainfully to condemne men that will search out the secretes of their artes and professions, and publishe the same to the behoofe and vse of others, no more then they woulde that others shoulde iudge of them, for promising much and performing little or nothing at all. Aristotle saith, that euerie man is best to be beleeued in his owne professed Art and Science. Now (curteous reader) I am to request thee to accept of this my discourse, wherein I haue taken some paines (as the trauaile it selfe may testifie) and beene at some charge,

for the more carefull and orderly handling of such matters as are necessarily incident to this presente treatise: All which I haue beene content to doe, that the worke (though it bee not big, yet effectuall) by the common vse thereof, may yéeld profit accordingly, to them specially that are of capacitie to comprehend this new reuealed secret. To conclude, the chiefest and onely marke whereat I lay leuell, was the benefiting of my Country-men, in whom I wish continuall increase of knowledge and cunning, as in all other commendable professions, so chiefely in those that are most necessarie and profitable. Thus bequeathing my trauaile heerein to thy discréet construction and wishing thy furtherance in this most necessarie and profitable knowledge,

I leaue thée to the direction of Gods holy Spirit.

Fare-well,

Robert Norman.

The Magnes or Loadſtones Challenge.

Giue place ye glittering ſparkes,
ye glimmering Diamonds bright,
Ye Rubies red, and Saphires braue,
wherein ye moſt delight,
In breefe yee ſtones enricht,
and burniſht all with gold,
Set foorth in Lapidaries ſhops,
for Iewels to be ſolde.
Giue place, giue place I ſay,
your beautie, gleame, and glee,
Is all the vertue for the which,
accepted ſo you bee.
Magnes, the Loadſtone I,
your painted ſheaths defie,
Without my helpe, in Indian ſeas
the beſt of you might lye.
I guide the Pilats courſe,
his helping hand I am,
The Mariner delights in me,
ſo doth the Marchant man.
My vertue lies vnknowen,
my ſecretes hidden are,
By me the Court and Common weale,
are pleaſured verie farre.
No ſhip could ſayle on ſeas,
her courſe to runne aright,
Nor compaſſe ſhew the ready way,
were Magnes not of might.

Bluſh then, and blemiſh all,
bequeath to mee thats due,
Your ſeates in golde, your price in plate,
which Iewellers doo renue.
Its I, its I alone,
whom you vſurpe vpon,
Magnes my name, the Loadſtone cald,
the prince of ſtones alone.
If this you can denie,
then ſeeme to make reply,
And let the painefull ſea-man iudge,
the which of vs dooth lye.

The Mariners iudgement.

THE Loadſtone is the ſtone,
the onely ſtone alone,
Deſeruing praiſe aboue the reſt,
whoſe vertues are vnknowne.

The Marchants verdict.

THe Diamonds bright, the Saphirs braue,
are ſtones that beare the name,
But flatter not, and tell the troath,
Magnes deſerues the fame.

the Contents of this Booke at the end of the Booke

The new Attractiue.

The first Chapter.

Of the Magnes or Loadstone, where they are found, and of their colours, weight, and vertue in drawing yron or steele: and of other properties of the same stone.

THE Magnes or Loadstone is found in diuers partes of the worlde, and most commonlie in Yron Mynes, and although it bee ponderous and weightie, yet it is not found to be of the Yron Ewre, neither conteineth in it any metall of it selfe, but hath a certaine affinitie into yron or steele. It was called Magnes, because the first finder thereof was so named, who (as Plinie writeth) was an Herdsman in East India.

This stone (as writeth Cardinal Cusan) hath substance, vertue, and operation. His vertue is conserued & nourished of his substance: & of this vertue proceedeth diuers strange effects and operations, serving to many good purposes, as (specially in the arte of Nauigation) without whiche there could haue beene no discoueries by sea, nor the partes of the world made knowne & frequented as now they are, and therefore the vertue of this stone of all others may bee accounted the most precious.

Of these are diuers sortes differing each from other, as well in goodnesse, as in colour, weight, and force, but not in propertie (although many haue iudged the variation of the needle, to bee according to the distance of the Mine where the stone was bred, to the place where hee is vied.)

The

The first and best sort of these stones come out of the East India, from the coast of China, and Bengalia, and is of the colour of yron or sanguine colour: these stones are verye massiue & weightie, & will drawe or lift vp the iust weight of it selfe in yron or steele (if the stone exceede not a pound weight.) And these are of the finest sort, and are sold commonly for their proper weight in siluer in the East India, where they growe, because the best & finest are verie rare to be found. For it is commonly a sole stone, lying by himselfe in the earth, and no shell or peece of another.

The best Loadstone.

There is another sort of a reddish colour found in Arabia and the red Sea, growing broad and flat, much like to a Tilestone or Slate: this is not so weyghtie as those of China, but it is verie neere as good, and the vertue continueth long on the Compasse or Needle that is touched with it.

Next the best.

There is likewise of these stones in Leuant, in the Ile of Elba, hard by a towne in the same Ilande called Porto Ferraro, from whence our Mariners daylie bring of them, and are called there Calamita Preta, that is to say, The blacke Magnes, because there is another sort that is white and light, lyke vnto a peece of dry Fullers clay, and is called Calamita Blanca.

This Calamita Blanca is founde alwayes with the other, sticking fast in the out side thereof lyke claye. And this white is forbidden to be vsed in that Country, because euill women there, doo applye it to destroye conception, whereof this stone is a great enemie. Other thinges are noted of this white Calamita, for obtaining of wanton purposes, which I thinke not credible, and therefore will omit it. These blacke stones of Elba are mingled with white veynes, they are of no great force, nor their vertue of long continuance.

Also there are of these stones in high Almaine, that are full of holes like a hunnie combe, & lighter then the other, but yet very good, and these are of yron colour.

Another

Another ſorte there is in Norwaie, in the yron Mines, as in Lodhſounde, and other places, their couleur is blacke, mixed or as it were interlarded with graie, theſe are of the ſmalleſt force of any that are found. The worſt.

I haue ſeene alſo in the Mines of Caramaca in Spayne of a graie colour, but of no greate force: theſe are commonly brought by horſe downe to Siuill and Callis to bee ſould, and oftentimes to Valentia, Alicante, and Lisbone.

All theſe ſtones are different one from another, as well in force as in colour and weight: yet all of one operation in the Needle, ſhewing one poinct Attractiue, as I haue proued my ſelfe by three ſundry ſortes of them, which I haue: and all drawing yron to them. Yet the Philoſopher Auctroes writeth that the Magnes draweth not yron vnto it, but the yron of his naturall inclination moueth to the Stone.

And though this poſition may ſeeme to carrye ſome trueth with it, by the bare veiw of the ſight, when the yron is lighter then the Stone: yet contrariewyſe you ſhall finde, that the Stone will moue to the yron, if the Stone bee good, and the yron of greater weight then the Stone (ſo that the weight of the Stone exceede not hys Attractiue ſtrength.)

Neuertheleſſe wee may not thereby take away the vitall or liuely ſpirite from the Stone, and attribute it vnto the yron: for in ſo doing we ſhoulde doe Nature greate wrong. For it is apparant, that the yron hath no Attractiue vertue, nor power of it ſelfe, vntill it haue receiued it of the ſtone. But yron hauing a certaine affinitie, or naturall qualitie agreeable to the ſtone, doth aptly and freely receiue his vertue, and as a ſubiecte, ſuffereth his vitall ſpirit of the ſtone to imprelle, and reſt quietly in his maſſiue and ſolide bodie, which when it hath receiued by touching the Stone, it is indued with the very ſame propertie and operations in all reſpectes (though not in ſo great force) as the ſtone it ſelfe. The vital and naturall ſpirit & operation of the Loadſtone.

For

For as the Stone hath power to shewe the Attractiue point, so hath the touched Yron. As the Stone hath two principall poinctes, , so hath the Yron. And likewise, as the stone hath power to drawe yron to it, so will the Yron so touched, drawe another yron to it, and impart all these vertues to another yron in qualitie, though not in quantitie: and thus in all respectes it conteineth in it, the verie propertie of the stone.

Paracelsus writing of the augmenting of the Strength of the Magnes Stone saith, that if this Stone bee laide in the fire, vntyll it bee almost redde hot, and then taken out and quenched in the Dyle of Crocus Martis, it will so augment and multiply his force, that it will pull a nayle out of a wall. But I suppose he meant not that the naile should be fast, for then it were a miraculous matter.

Others haue written, that in those partes, where the Magnes groweth in the Sea, it is of such force, that if anie Shippes that haue yron in them passe by, or ouer them, that they are presently either staied, or drawen downe to the bottome by reason of the yron. Not these onely, but many other fables haue beene written by those of auntyent time, that haue as it were set downe their owne imaginations for vndoubted truthes, and this most of all in Geographie and Hidrographie, or Nauigation. Therefore I wilbe experience to be the leader of Writers in those Artes, and reason their rule in setting it downe, that the followers be not led by them into errours, as oftentymes haue beene seene.

Trew it is, that God is mightie and marueilous in all his woorkes: yet hee doeth not allowe vs to say more then truth of them: And truely, this power is as greatly shewed in the Magnes, as in any stone that hee hath created: and who so shall goe about curiouslie to seeke out the efficient cause of his properties, I suppose the longer hee seeketh, the more he shall marueile, and yet neuer the nerer his purpose.

The

The vertue of the Stone is distributiue, as many other vertues are, much comparable vnto Muske, that hauing a sweet sauour or smell it selfe, imparteth the same to another thing, as to a paire of Gloues, and those Gloues giue out sauour, and perfume a whole chest of cloathes. Euen so the yron that hath receiued this vertue of the stone will extend, and giue the same to another, and that yron to another, and so to many.

And in this point the stone is maruellous, that notwithstanding you touch ten thousand yrons or nailes with him, euery one of them carrying away as much vertue as will lifte vp another his lyke (so they exceed not the weight of a fiue penny naile) yet the Stone it selfe will be nothing diminished of his strength, but continue of one force.

If I should say heere, that by the Attractiue strength of a small Magnes of two or three pounde weight, I could lift vppe, or cause to hange by the vertue thereof, a thousande pounde of yron at one instant, peraduenture you would bee doubtfull of the successe. Neuertheless by experience in all thinges, wherein consisteth truth and reason, of necessitie reason must yeild, when truth is present. And therefore because you shall not remaine doubtfull herein, thus you may dooe it, and onely make proofe by two or three nailes, if you will: for the same successe that you haue in them, you shall haue in all the rest.

Take a common boord nayle, & touch the head of it with the North parte of the Magnes or Loadstone, then take the same nayle and beate it with a peece of woods lightly into some poste or timber vpwardes, so as the heade maye hange downe wardes, (but not with yron, because the yron will take away some parte of the vertue from the nayle:) this done, take another like naile, and touch the head therof with the South parte of the Stone, and then if you put the head of it to the head of the first naile, it wil hang fast by it a whole yere or more. And after this manner you may, if you will take the paines, hang a hundred tun of iron with

the

the vertue of this little stone, and yet the stone nothing diminished of his force. But it is necessarie in proofe of this matter, that you haue a very good stone.

Irons to hang one by another by vertue of this stone.

Furthermore, concerning the other properties of this stone, if you put it in a dry dishe, and sette it to swimme in a tub of water, it will turne the dish about, and the North parte of the stone, after many swarninges to and fro, will rest, and directly shewe the line of Variation, or imagined Attractiue point.

Also, if you hang this stone by a thrid, that it may easilie moue, it will shew the like effects as on the water. And if you haue two stones, putting the two South partes of them together, the one will flye and turne away from the other, and likewise of the North pointes.

A special note

And further yee shall note as a speciall point, that the North point of the stone touching a Needle, or the wyers of a compasse, will make the same point touched to shewe the South: and contrariwise, beeing touched with the South point, will make the same to shew the North. So as alwaies that part of the stone that answereth to the North of the Needle, is properly the South part of the stone.

The second Chapter.

Of the diuers opinions of those that haue written of the Attractiue point, and where they haue imagined it to be.

THE subtill properties, and hid secretes of Nature in the Magnes, as also in diuers other thinges, hath so troubled the wits of the searchers thereof, that alwayes when they came to the vpshot, wanting experience, and thereby reasons finger to shew them a direct marke, they were constrained to seeke out imagine a marke, where in deede none at all was, and thus shooting

shooting as it were in y aire, euerie man where he thought best, they haue all shot wide, and none touched the marke. The marke I meane heere, is the point Attractiue, or rather, as shall bee saide hereafter more at large, the point Respectiue.

This point, auncientlie called the Attractiue point, hath beene by some imagined to be in the mooning spheres distant from the poles of the worlde: which opinion Martin Curtes in his Booke of Nauigation refuting, saith, that if it were so, then the same point beeing carried about the pole by their violent motion, woulde cause the Needle or Compasse touched with the vertue of the Stone, to varie dayly in euery place, according to the diurnall motion of the same sphere. But in confuting the errenious opinion, he hath (as it appeareth) fallen into as greate an error himselfe: imagining the pointe Attractiue to bee beyond the poles of the worlde, without all the moueable heauens. Which point (saith he) hath power by Attraction to draw yron to it, that is touched with the Loadstone. This error I referre to be discussed in the first Chapter.

Others haue taught this point to be in the earth, neere the North pole, imagining in that part to bee some great rocks of the Loadstone, & that by their Attraction the compasse or needle is caused to Respect or shew that part.

This opinion of all the rest is easiest to bee confuted by daily experience: for if the compasse or needle were drawn towardes the North parte by any Attraction of the Magnes stones in those partes imagined, why then should not the Compasse or Needle shewe the same effecte in mooning towardes the Iland of Elba in the Leuant seas, where are great quantitie of these Stones? and yet Shippes sayling within a myle of this Iland, yea, and into Porto Feraro a Towne of the same Ile, within a quarter of a mile of a huge Rocke of these stones the Compasse or Needle is not found any thing to be drawne or chaunged, nor the Attraction of this huge rocke to extend so farre as one

quarter of a mile. And as I haue said by this, so may I say by diuers other places where the Loadstone are founde in Cliftes and Mines neere to the Sea side, as in Norwaie and other places.

Pedro de Media in his booke of Nauigation is of the opinion of Martin Cortes as touching the Attractiue point, but he doth not allowe of the variation of the compasse or needle, but saith that if the compasse or needle shewe not the pole, the fault is in placing the letters on the flie, & not in any propertie it hath to vary.

These opinions by diuers, but the chiefest cause why they haue gone so farre wide from the Attractiue poynt, as I haue aboue said, was because they wanted reasons fingers to shewe them towardes the direct marke. By this reasons finger, I meane a certaine Declining propertie vnder the Horizon, lately founde in the Needle, which I will entreate off at large.

The third Chapter.

By what meanes the rare and straunge Declyning of the Needle, from the plaine of the Horizon was first found.

HAuing made many and diuers compasses, and vsing alwaies to finish and end them before I touched the Needle, I found continually that after I had touched the yrons with the Stone, that presently the North poynt thereof would bend or Declyne downwardes vnder the Horizon in some quantitie: insomuch that to the Flie of the Compasse, which before was made equall, I was still constrained to put some final peece of ware in the South parte thereof, to counterpoise this Declining, and to make it equall againe.

Which effecte hauing many times passed my handes without

without any greate regarde thereunto, as ignorant of any such propertie in the Stone, and not before hauing hearde nor read of any such matter: I chaunced at length that there came to my handes an Instrument to bee made, with a Needle of fiue inches long, which Needle after I had polished, cut of at iust length, and made it to stand leuel upon the pinne, so that nothing rested but onely the touching of it with the stone: when I hadde touched the same, presently the North part thereof Declined downe, in such sort, that beeing constrained to cut away some of that parte, to make it equall againe, in the end I cut it to short, and so spoiled the Needle wherein I had taken so much paines: whereby beeing stricken into some choller, I applyed my selfe to seeke further into this effecte, and making certaine learned and expert men, my friendes, acquainted in this matter, they aduise mee to frame some Instrument, to make some exact triall, how much the Needle touched with the Stone would Decline, or what greatest Angle it would make with the plaine of the Horizon. Whereupon I made diligent proofes, the manner whereof is shewed in the Chapter following.

The fourth Chapter.

How to find the greatest Declining of the Needle vnder the Horizon.

TAke a small Needle of Steele wier of fiue or sixe inches long, the smaller and the finer mettall, the better and in the middle therof (crosse the same) by the best meanes you can, fixe as it were a small Axeltree of Iron or Brasse, a straw inch long, or thereabout, and make the ends thereof verie sharpe whereupon the Needle may hang iuell, and play at his pleasure.

Then prouide a round plaine Instrument like an Astro-

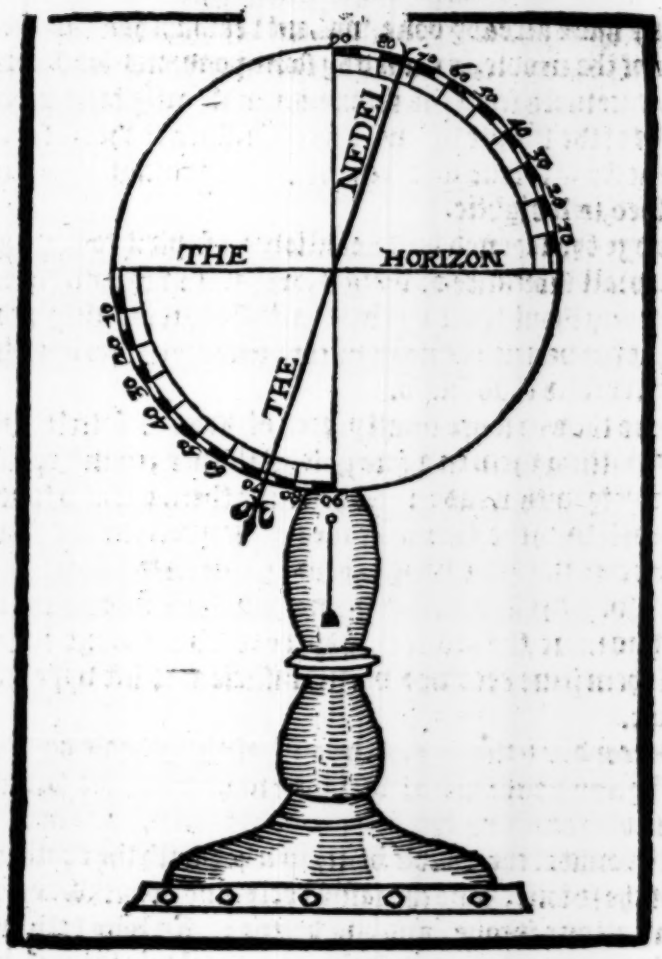
lobe, to be deuided exactly into 160. partes, whose diameter must be the length of the Needle, or thereabout, and the same instrument to bee placed vppon a foote of conuenient height, wyth a plumme lyne to sette it perpendicular.

Then in the Center of the same Instrument, place a peece of Glasse hollowed, and against the same Center vppon some place of Brasse that may bee fired vpon the foote of the Instrument, fit another peece of Glasse, in such sorte that the sharpe endes of the Axeltree beeing borne in these two Glasses, the Needle may playe freely at hys pleasure, according to the standing of the Instrument.

And the Needle must be so perfected, that it may hang vpon his Axeltree both endes leuell with the Horizon, or beeing turned, may stande and remaine at any place that it shall be sette: which being done, touch the saide Needle with the Magnes stone, and set the Instrument perpendicular by the plumme lyne, and turne the edge of the Instrument South and North, so as the Needle may stande duely according to the Variation of the place: which Variation the Needle of his owne propertie woulde shewe, were it not that hee is constrained to the contrary by the Axeltree.

Then shall you see the Declination of the North point of the touched Needle, which for this Cyty of London, I finde by exact obseruations to be about 7 1. degrees 50. mynutes. The forme of the Instrument heere described, with the manner of the declination, I haue heere placed that it may be the easier conceiued.

The



The fift Chapter.

That in the vertue of the Magnes or Loadſtone, is no ponderous or weightie matter, to cauſe any ſuch declining in the Needle.

BEcauſe the opinions of men are diuers, and the argumentes of many againſt reaſon peraduenture there are ſome will ſay, that I am deceiued euen in the grounde & chiefeſt point of this my purpoſe, alleaging

(as some haue already done without reason) that this Declining of the needle, is caused by some ponderous substance that it receiueth from the Stone, and not (as I take it) to proceede of the simple vertue, & secret influence thereof, because the stone it selfe wherein the vertue remaineth and is nourished, is weightie.

I iudge the learned will not allowe a Spirit to haue any corporall substance or weight, or that it may sensibly be felt: if any should, yet by two conclusions it is easily proued, that the vertue of this stone containeth in it no waightie matter: and thus found.

Take three or foure small peeces of Iron or Steele wier, and putting them in a fine gold Ballance, counterpoise them iustly with Leade: Then take them out and touch them well with the Stone, that they may receiue the vertue thereof: And after weigh them againe in the same ballance, with the same Lead, and you shall finde them to weigh no more, thē before they were touched, though euery one of them haue receiued vertue sufficient to lift vppe his fellowe.

Secondlie if the he North point of the Needle do Decline by any ponderous or weightie matter, in the vertue receiued by touching the Stone, why then should not the South point of the Needle being touched with the contrary end of the Stone, haue the same declyning Southwardes, beeing all one Stone, and one vertue? Or why doth not this supposed heauier end, fall perpendicularly to the Center, as by reason it should, and not couet a certaine scituation beside it, ballancing it selfe vp and downe, till it haue found the same? These argumentes may aunswere thys matter. For touch the Needle with what part of the Stone you liste, that end of the needle that sheweth the North, will alwaies decline.

The sixt Chapter.

A confutation of the common receiued opinion of the point Attractiue.

Seeing

Seing it is manifeſt that there is a Declining in the needle, and that the ſame is not cauſed by any ponderous waighty matter in the vertue receiued from the Stone: it may be demanded, by what means this declining or eleuating happeneth: in which of the two pointes conſiſteth the action or cauſe thereof.

Peraduenture you will ſay (as other haue imagined) that it is in the South point of the Needle, eleuated by the Attractiue vertue of ſome point of the Heauen that way. Perchaunce you will yéeld it rather to be in the North point of the Needle, which by ſome Attractiue point in the Earth, or in the Heauens, beyond the Earth that way, is drawen downe and cauſed to declyne, and it Declining, of neceſſity the other South point oppoſite muſt needes be lifted vp.

Your reaſon towards the earth carrieth ſome probabylitie, but I proue that there be no Attractiue, or drawing propertie in neither of theſe two partes, then in the Attractiue point loſt, and falſely called the poynt Attractiue, as ſhall be prooued. But becauſe there is a certaine point, that the néedle alwayes reſpecteth or sheweth, beeing voyde and without any Attractiue propertie, in my iudgement this point ought rather to bee called the poynt Reſpectiue.

And further if it may be proued, that there is no Attractiue or drawing propertie in that point, the power & action in that point condemned, then of neceſſitie the power and propertie, without any externall cauſe, remaineth onely in the Stone, and after in the néedle beeing touched with it, hauing the ſame power & propertie in it, that the Stone hath in euerie reſpect.

Now to proue no Attractiue point neither beneath in the earth, nor Heauens Northwardes, nor aboue in the heauens Southwardes, you ſhall take a peece of Iron or

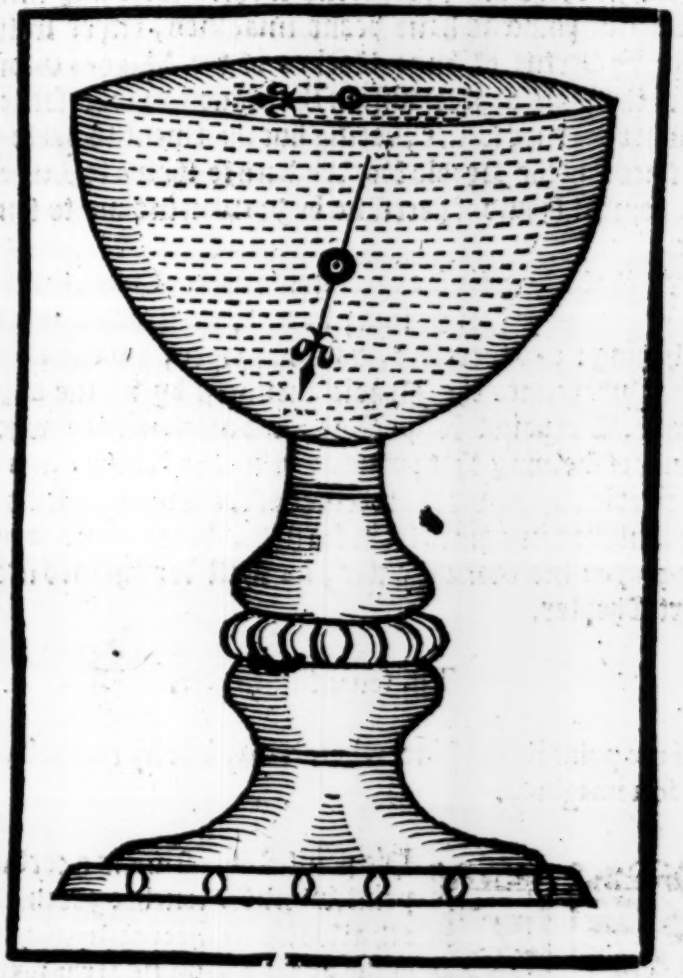
Steele wier of two inches long or more, and thrust it into a peece of close Corke, as bigge as you thinke may sufficiently beare the wier on the water, so as the same Corke rest in the middle of the wier.

Then you shall take a deep Glasse bole, cuppe, or other vessell, and fill it with faire water, setting it in some place where it may rest quiet and out of the winde. Thys done cut the Corke circumspectly by little and lyttle, vntil the wier with the Corke bee so fitted, that it may remaine vnder the superficies of the water two or three inches, both endes of the wier lying leuill with the superficies of the water, wythout ascending or descending, lyke to the beame of a paire of ballance beeing equally poised at both endes.

Then take out of the same wier without mouing the Corke, and touch it with the Stone, the one end with the South of the Stone, and the other end with the North, and then sette it againe in the water, and you shall see it presently turne it selfe vpon his owne Center, shewing the aforesaide Declining propertie, without descending to the bottome, as by reason it shoulde, if there were any Attraction downwardes, the lower part of the water being neerer that point, then the superficies thereof.

And as this may proue no Attraction or drawing downwardes: in like maner the Corke being so made, that it may sinke very slowly to the bottome, and then taken out and touched with the Stone, and put in againe downe to the bottome with your finger, if any Attractiue drawing were vpwardes, it woulde ascend, and come vp to the superficies of the water, beeing neerer to that point than the bottome. But I finde by diligent and exact triall, that it hath no such effecte: as in the figure following is demonstrated.

Againe,



Againe, if you doe fit your wier with Corke, that after it is touched with the Stone, it will swim leuell in the superficies of the water, you shall see it turne to shew the true Variation, and leauing the same in the middle of the superficies of the water, so long as you list, you shall finde that it will not bee drawen from his place, neither to the one

one side, nor the other, whereas if there were any such Attractiue point as haue beene imagined, either in the earth by vertue of huge Rockes of the Magnes stone neere the Pole, or otherwise in the heauen, or wherſoeuer, by what meanes ſoeuer, being but the twentith parte of the force that the Needle touched, hath to shewe to Reſpectiue point, it ſhould of neceſſitie be drawen in time to some side.

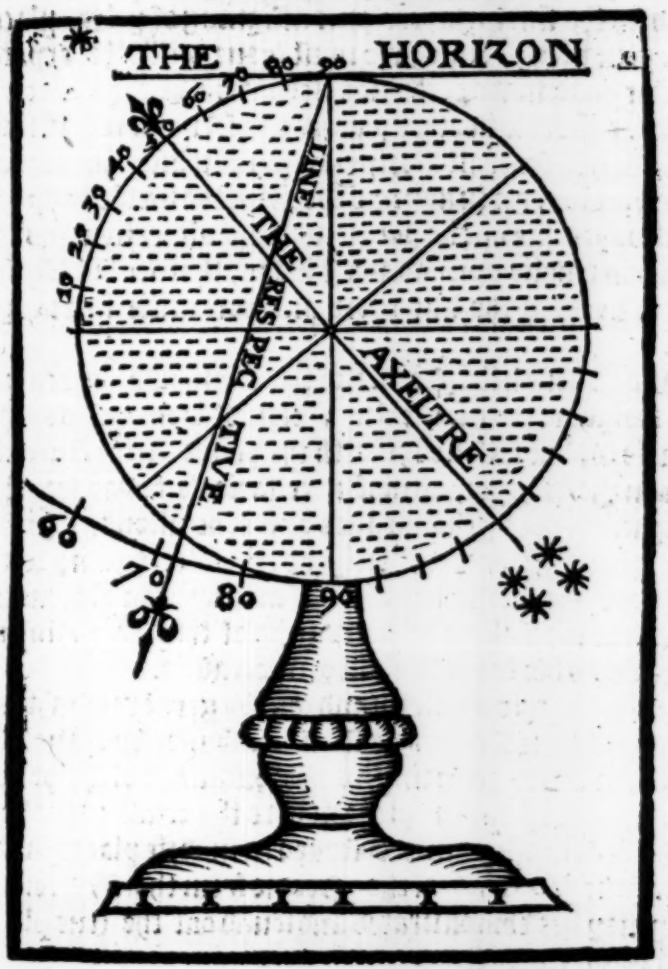
So that vppon theſe experimentes I conclude, that the Attractiue poynt before imagined, is no where, nor no ſuch thing: and therefore, as moſt proper, I will call the point whereunto the Needle inclineth by vertue of the Stone, The point Reſpectiue, and attribute the whole power of shewing that poynt to be in the Stone, and in the needle, by the vertue receiued of the Stone, which vertue muſt bee imagined to be turned, borne, and depending vpon his owne Center, as ſhall bee ſhewed in the next Chepter.

The ſeuenth Chapter.

Of the point Reſpectiue, where it may bee by greateſt reaſon imagined.

THis point Reſpectiue, is a certaine point, which the touched Needle doeth alwaies Reſpect or ſhew, and is found by the declyning of the needle, to bee a pricke in ſome one part of a ſtraight lyne, declyning in this place or Latitude of London vnder the Horizon 71. degrees, and 50. Minutes, as this figure following repreſenteth.

This



This ſtreight lyne muſt bee imagined to proceede from the Center of the Needle, into the Globe of the earth, extending & going directly ſouth both waies infinitely. But in what parte of this line the point Reſpectiue is, it is not by this bare lyne alone to be anſwered, no more then it is poſſible by one bare angle to meaſure or know the diſtance of any place aſſigned.

And

And for the finding or certaine assigning of ỳ true place of this poinct Respectiue, we must leaue vntill the expert trauailer haue made certaine obseruation of thys Declyning of ths Needle in other places. For seeing it is certaine that though in seuerall Horizons, the compasse hath seuerall Varations: yet in any one Horizon, the nẽdle Respecteth alwayes one onelie poinct without alteration, as by trauailers truelie prooued. So I iudge, that in his Declinyng, it keepeth the like order and certaintie in euerye place.

And although the Needle of the Compasse, by reason of the weight of the heauie flie, cannot Decline, as hys propertie is, but falselie sheweth the poinct Respectiue alwaies in the Horizon, as most necessarie so to doo for the Nauigation: yet by the meanes and conclusions, whiche before I haue shewed, the diligent traueller hauing with him a good Magnes or Loadstone, may by exact obseruation finde the increasing or decreasing of this Declining of the needle, as his trauaile shall giue occasion.

For I am of this opinion, (and that by great reason) that this Declining of the Needle shall bee founde by trauell to be great or little, according as the distaunce of the poinct Respectiue, is from the place where the triall is made: whiche beeing diligentlie obserued in sundrie places, with the certaine Variation of the Needle from the Meridian, therby may bee demonstrated and found out the true place of this poinct Respectiue.

The eight Chapter.

Certeine proofes that the power and action is wholie and freelie in the stone, to shewe this poinct Respectiue: and in the Needle, by vertue & power receiued of the Stone: and not forced or constrayned by anie Attraction in heauen or earth.

IT is moste manifest in all the woꝛkes of Nature, oꝛ creatures that God hath made, that whatsoeuer qualitie, pꝛoperty, oꝛ vertue is founde in them, by creation, that is to bee holden foꝛ their owne. And he that shall, by imagination oꝛ coniecture, goe about to take these their pꝛoperties from them and attribute the same to any other subiecte whereunto they appertaine not, I say that man offendeth God muche, foꝛ not beleeuing his powꝛer to bee sufficient in hys creatures.

I will not offer to dispute with the Logitians in so many poinctes as heere they myght seeme to ouer reach me, in naturall causes. But that this stone hath wholy and fully in himselfe powꝛer, action, pꝛoperties vertue of his owne appetite to shew and to cause the Needle to shewe the point Respective, without anie Attractiue qualitie, oꝛ external cause of Rockes of the Magnes Stone, oꝛ by Attraction in the heauens, oꝛ else where whatsoeuer, it is already sufficiently pꝛoued.

Notwithstanding, if these pꝛooses may not content, I will at any time required heerein, satisfie the doubtfull by manyfest experimentes. And therfoꝛe where no other cause can be pꝛobablie annexed vnto this stone, the powꝛer and action of necessitie is pꝛoued in it selfe.

And by the Declining of the Needle, is also pꝛoued, that the poinct Respective is rather in the earth then in the heauens as some haue imagined: and the greatest reason why they so thought, as I iudge, was because they neuer were acquainted with this Declining in the Needle, which doubtlesse if Martin Curtes had knowen, hee would not haue iudged the Attractiue poinct to haue beene in the heauens, oꝛ without them, but rather in the earth.

Now peraduenture you will aske me howe this Stone hath his powꝛer, and how it is ingendꝛed; I am no moꝛe able to satisfie you heerein, then if you should aske me howe

and

and by what meanes the celestiall spheres are moued: but that God in his omnipotent prouidence hath appointed it so to be: which may serue for a generall answer, to all such curious searchers of the secret workes of God in his creatures. As though his worde alone were not a sufficient decree and lawe to all his workes: but binding them to second causes, as a thing of necessitie.

These curious searchers out of the secretes of nature, further then is requisite that man should knowe for his necessarie vse, I may compare to Esdras; and wishe them to read ouer his fourth booke, and there they shall see how he was answered at Gods handes by his Angell, for his curious questions asked and demaunded.

Nowe therefore, as I haue before declared, that diuers haue sought their wits, yea, and dulled them; as I haue mine, and yet in the end haue beene constrained to flie to the certaine Stone, I meane God, who (to conclude) hath giuen vertue and power to his Stone, proper in it selfe, to the woorke certaine poinct, by his owne nature and appetite, and not subiecte to any other accident in heauen, nor in earth, but freely by his owne proper vertue receiued at his mightie handes in creation: and by the same vertue the needle is turned vpon his owne Center, I meane the Centre of his Circular, and inuisible vertue, pearcing all thinges and staied by nothing, be it wall, doore, glasse, or any thing whatsoeuer.

And surely I am of opinion, that if this vertue coulde by any meanes be made visible to the eie of man, it woulde be found in a Spherical forme extending rounde about the Stone in great compasse, and the deader poinct of the Stone in the middest thereof, whose Center in the Center of his attractiue vertue. And this I haue partly proued and made visible to be seene in some manner, and God sparing mee lyfe, I will herein make further experience, and that not curiously, but in the feare of God, as neere as he shall giue me grace; and meane to annexe the same vnto a booke of

Nauiga-

Nauigation, which I haue had long in hand.

The nienth Chapter.

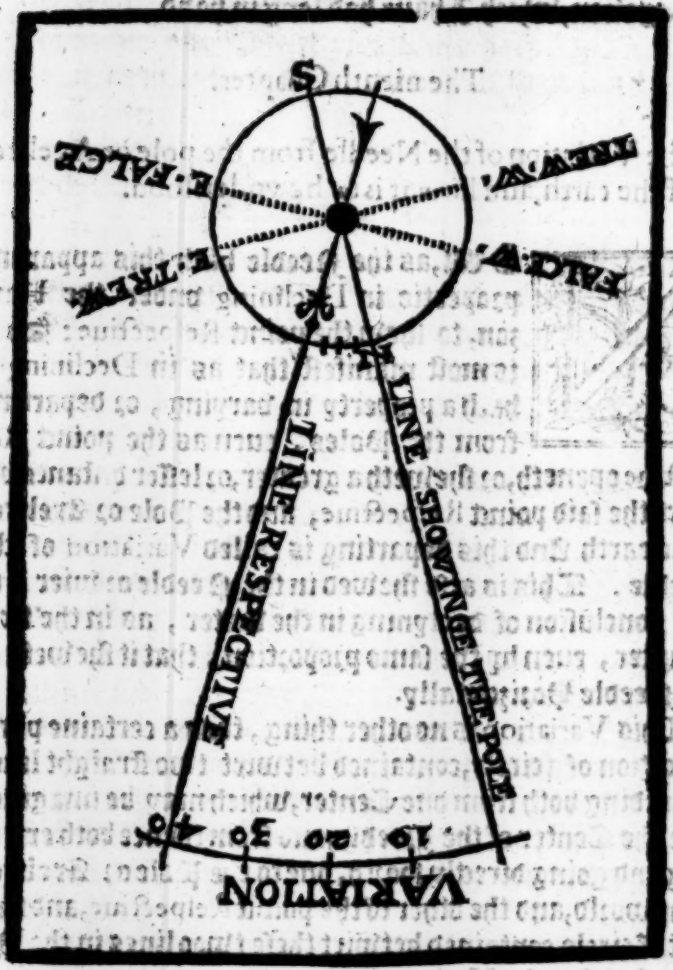
Of the Variation of the Needle, from the pole or Axeltree of the earth, and how it is to be vnderstood.

NOw, as the Needle hath this apparent propertie in Declining vnder the Horizon, to shew the point Respective: So it is most manifest that as in Declining it hath a property in varying, or departing from the Poles, euen as the point Respective openeth, or sheweth a greater, or lesser distance betwixt the said point Respective, and the Pole or Axeltree of the earth. And this departing is called Variation of the Needle. This is also shewed in the Needle or wier in that conclusion of declyning in the water, as in the 8. Chapter, euen by the same proportion, that it sheweth in the Needle Horizontally.

This Variation is no other thing, then a certaine parte or portion of a circle, contained betwixt two straight lines proceeding both from one Center, which may be imagined to be the Center of the Needle, and from thence both ending and going directly North, one to the Pole or Axeltree of the world, and the other to the point Respective, and this part of circle contained betwixt these two lines in the Horizon, is said to be Variation.

And further heere is to be noted, that alwaies these two lines haue two right lynes, cutting them directly in the Center of the needle. The one of them crossing the Meridian at right angles in the Center of the needle, is the true East and West of the worlde. And the other crossing the line Respective at right angles, is the false East and west that the varying Needle or Compasse sheweth: all which is shewed by this present figure following.

This



This Variation is iudged by diuers trauailers to bee by equall proportion, but heerein they are much deceiued, and therefore it appeareth that notwithstanding their trauaile, they haue more followed their bookes then experience in that matter. True it is, that Martin Curtes doth allowe it to bee by proportion, but it is a moste false and erronious rule. For there is neither proportion nor vniformitie in it, but in some places swift and sudden, and in some places slowe.

At

It is said to be proportionall or vniforme, when in the increasing or decreasing of a degree of Variation, is found one certaine number of leagues or miles, going, increasing or decreasing in one Paralell or Latitude, by like equall proportion, and that if the Variation be doubled, going by one paralel, so shall the leagues or miles also. But this is not found to be so.

For in going from Sillie to Newfound-land, which is not 600. Leagues, it is found that the Needle doeth varie more in 200. Leagues, when you come neere that Countrie, then it doth in 400. Leagues of your first way. And also going to Meta Incognita, it varieth more in parte of the last of the way, the in ½ of the firste: and in those partes it is found to bee sodaine. Further it is found betweene the North Cape and Vaigatz verie strange, in recoyling and comming backe againe to the Westwardes of the Pole before it hath fullie accomplished two pointes of variation in the compasse. So that at Vaigatz it varieth to the Westwardes, as it doth at Newfound-land. And this comming backe againe, before it hath accomplished four pointes of the Compasse, is verie strange, and against the opinions of all that haue before written.

Because the line of the Needle that sheweth the Pole Artik, and point Respectiue, by vertue of the stone passeth betweene Silly and Newfound-land.

Pedro de Medina (as I haue said in the seconde Chapter) was doubtfull of the Variation, saying: that if the Compasse did varie, the faulte might bee in the making thereof, the wiers or Needle not being well placed: yet he was a learned man, and a great traueller to the West Indies. But it appeareth that he had no more regard to the Variation, then many Mariners in these daies.

For in 18, or 20. yeares that I haue traueiled, the seas beeing dayly conuersant with many of them, and diligent in enquiring of Variation of the places, where I haue not beene my selfe, I could neuer finde two of them in one trueth, except for the trauailes from hence Northwardes, and North Eastwardes. But I suppose the greatest occasion thereof is by lacke of exacte Instrumentes for

that purpose. Wherefore I haue deuised one verie necessarie.

And further because this variation is diuers, and is found sometimes to the Eastwards, and sometimes to the Westwardes of the Pole, I wil declare what the variatiõ is heere in London, by mine owne obseruation, and in other places, as I haue grosse gathered of some trauellers, reckoning, or beginning at the ancient bound or great Meridian that passeth by the Ile of Saynt Michaell in the Asores, where it is said, that the Needle sheweth directly the Pole, and the Respectiue point both in one line. But this is not found to be so.

True it is, that the North point of the common Compasse sheweth the Pole verie neere in that Meridian, but the bare Needle sheweth about 4. deg. 50. min. to the eastwards of the Pole. So that you must vnderstand alwaies, the difference betweene the common Compasse & the Needle to be at the least ½ part of a point, and of some more: because the greatest part of the common sailing Compasses hath the Needle set in the Flye, halfe a point, or ½ to the Eastwardes of the North, and some ¾ of a point, and others at a whole point, and some againe are set directlie vnder the Flowerde Luce, or North of the Compasse, these are called Meridionall Compasses, because they shew directly the Pole in the great Meridian, as the bare Needle doth, which Meridian must needes bee at the least 100. or 120. leagues to the Westwards of the Ile of Saint Michaell.

And therefore to write of the Variation of places by the common reportes of Mariners, that haue trauelled Southwards and Westwards from hence, it shall bee as vncertaine, as are the diuers makinges of these common compasses, by which they haue made their obseruations. And therefore I will omit it, and speake onely of this place or Cittie of London, whose latitude I finde to bee 51. degrees, 32. min. and the Variation of the Needle from this

Meridi-

Meridian of the Pole to be 11. degrées. 15. minutes.

And although this Variation of the Needle, bée found in trauaile to be diuers and changeable, yet atanie Lande or fixed place assigned, it remaineth alwaies one, still permanent and abiding. And therefore I wish the Paryner to make diligent obseruation of thys Variation in dyuers places, as hee shall trauaile, by some exact Instruments for the purpose. For it may be greatly for his aid, against hee come there another time, especially in such places where the variation is swift, as in these Northy partes. And because the common Compasse is partaker of this Variation and Declyning, as the Needle is, I wil somewhat shewe of the sundrie sorts and makings of them, with the inconueniences that may growe by them, and by yll plats made by these diuers sortes of Compasses.

The tenth Chapter.

Of the common Compasses, and of the diuers different sorts & makings of them with the inconueniences that may grow by them, and the plats made by them.

OF these common sayling Compasses, I find heer in Europa fiue sundrie sorts or sets. The first is of Leuant made in Sycile, Genoua and Venice: and these are al for the most part made meridionally with the Myers directlye set vnder the South and North of the Compasse and therefore duelye shewing the point Respective in all places, as the bare Needle, and by this compasse are the Plats made, for the most part of all the Leuant Seas.

Secondly, there are made in Danske, in the Sound of

Denmarke, and in Flanders, that haue the wiers set at ½ of a point to the Eastwards of the North of the Compasse, and also some at a whole point, and by these compasses they make both the plats, and Rutters for the sound.

Thirdly, there hath beene made in this Countrey particularlie for Saint Nicholas and Russia, Compasses set at ⅔ of a point, and the first plats of that discouerie were made by this Compasse.

Fourthly, the Compasse made at Seuill, Lisbone, Rochell, Bourdeaux, Roan, and heere in England, are most commonly set at halfe a point, and by this Compasse are the plats of the East and West Indies made for their Pylots, and also for our coastes neere heerby, as France, Spain, Portugall, and England: and therefore best of these Nations to bee vsed, because it is the most common sorte that is generally vsed in these coastes. And againe, it is said, that the middle hazard is best.

I speake thus, because there are so many sortes of these Compasses different each from other, as before I haue declared. And the Maister or Mariner saying by these Compasses of sundry sortes, may thereby fall into great perrill, and the reason is, because that of long tyme these compasses haue beene vsed, and by them the Marine Plats haue beene described of sundry sorts, euerie one according to the compasse of that countrie.

If then hee take not the Compasse of the same sette or making that the plat was made my, then his Card or plat will shewe him one course: and the compasse when hee thinketh hee goeth well, will carrie him another way. And thus, when hee thinketh to fall with the place that his Card sheweth him, he shall bee as farre wide, as the Compasse he hath sailed by, is different from that his plat was made by.

This is the grounde and cause of many inconueniences, which is now too late to bee generally reformed: therfore I wish the Marriner to haue a greate regarde vnto this,

this, as a principall point in Nauigation, and not to saile by a Compasse of one partie, & plat of another: I meane that they haue a respect, as neere as they may, to sayle by a Compasse of that countrie where his plat was made.

Yet manie there are that vse our Compasse with Leuant Plats: but I suppose, without good consideration therein, they shall make but wide reckonings. And this hath beene sufficientlie of late experimented, by our Pariners, that haue vsed Leuant.

Peradventure there are some will say, that he knoweth a good Compasse, if he see it. I say the Compasse may be good, and yet not good for him, except his plat bee agreeable: As for example, a Leuant Compasse is a good Compasse to vse with a Leuant Plat, but it differeth from our compasse halfe a point more Easterlie. And others there are of Danske, that differ from ours ½ a point more Westerlie, and yet being vsed in their kind, are good compasses.

And therefore I conclude, that generally the best compasse is this sorte set at ½ a point, because the more parte of Compasses and Plats, dooth not differ from this aboue ½ of a point, except the two aboue named of Leuant and Danske.

I haue heard many say, that haue trauelled farre to the Southwardes, that the Compasse hath seemed to lose his force, and to waxe weake and dull. I iudge the cause is not by reason of the farre distance from the North Pole, but rather by beeing long absent from the Stone, for not beeing touched or refreshed therewith. And againe, the Pinne that beareth the Flie, may bee so dulled with long vsing, that the Flie is as it were stated, that it cannot play as it would, if it were sharpe.

Therefore, if you make it sharpe with a Whetstone, you shall finde it remedied: and also when you finde it light, or too tickle, you may dull the point of the Pinne, with the leafe of a paire of writing tables, vntill you may see the toppe thereof, and then the Compasse will bee

better for a high Sea. And thus by sharping and bulling of the Pinne, you may make your compasse fit for all Weathers.

HEERE AFTER FOLloweth a table of the Sunnes Declination, *commonly called a Regiment* for the Sunne, axactly calculated vnto the minute by the true place of the Sun, whose greatest declination for this age, is 23. Degrees 28 minutes, and may serue for 30. yeares without great errour.

Lanuary.

Leap yeare.			Firtt.			Second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
☉	☾	♑	☉	☾	♑	☉	☾	♑	☉	☾	♑
1	21	57	1	21	50	1	21	52	1	21	56
2	21	47	2	21	40	2	21	34	2	21	45
3	21	36	3	21	30	3	21	33	3	21	36
4	21	25	4	21	20	4	21	23	4	21	26
5	21	15	5	21	9	5	21	13	5	21	15
6	21	5	6	20	59	6	21	0	6	21	4
7	20	54	7	20	48	7	20	50	7	20	54
8	20	43	8	20	36	8	20	38	8	20	41
9	20	31	9	20	23	9	20	26	9	20	29
10	20	20	10	20	10	10	20	15	10	20	16
11	20	6	11	19	59	11	20	0	11	20	3
12	19	52	12	19	43	12	19	47	12	19	53
13	19	35	13	19	30	13	19	33	13	19	39
14	19	23	14	19	14	14	19	19	14	19	25
15	19	7	15	19	0	15	19	4	15	19	12
16	18	54	16	18	45	16	18	49	16	18	56
17	18	39	17	18	29	17	18	34	17	18	41
18	18	23	18	18	14	18	18	16	18	18	26
19	18	8	19	17	58	19	18	2	19	18	11
20	17	52	20	17	42	20	17	46	20	17	54
21	17	36	21	17	25	21	17	30	21	17	38
22	17	19	22	17	8	22	17	12	22	17	21
23	17	4	23	16	51	23	16	56	23	17	4
24	16	45	24	16	32	24	16	38	24	16	47
25	16	28	25	16	16	25	16	21	25	16	29
26	16	10	26	15	57	26	16	3	26	16	12
27	15	53	27	15	39	27	15	45	27	15	49
28	15	33	28	15	21	28	15	26	28	15	30
29	15	15	29	15	2	29	15	7	29	15	12
30	14	56	30	14	43	30	14	48	30	14	53
31	14	35	31	14	24	31	14	29	31	14	34

South declination.

South declination.

South declination.

Februarie.

Leap yeare.				First.				Second.				third.			
4				1				2				3			
1596				1597				1598				1599			
1600				1601				1602				1603			
1604				1605				1606				1607			
1608				1609				1610				1611			
1612				1613				1614				1615			
D	G	☿		D	G	☿		D	G	☿		D	G	☿	
1	14	19		1	14	4		1	14	10		1	14	14	
2	14	0		2	13	44		2	13	50		2	13	54	
3	13	40		3	13	24		3	13	30		3	13	35	
4	13	20		4	13	4		4	13	9		4	13	16	
5	13	0		5	12	43		5	12	49		5	12	57	
9	12	40		6	12	23		6	12	29		6	12	34	
7	12	19		7	12	2		7	12	8		7	12	14	
8	11	58		8	11	41		8	11	47		8	11	52	
9	11	37		9	11	20		9	11	26		9	11	32	
10	11	16		10	10	58		10	11	4		10	11	12	
11	10	55		11	10	36		11	10	43		11	10	50	
12	10	30		12	10	15		12	10	21		12	10	28	
13	10	10		13	9	55		13	9	59		13	10	6	
14	9	47		14	9	31		14	9	37		14	9	43	
15	9	27		15	9	9		15	9	14		15	9	21	
16	9	5		16	8	47		16	8	50		16	8	58	
17	8	43		17	8	24		17	8	28		17	8	36	
18	8	21		18	8	2		18	8	6		18	8	14	
19	7	58		19	7	39		19	7	44		19	7	50	
20	7	36		20	7	16		20	7	21		20	7	28	
21	7	13		21	6	53		21	6	58		21	7	5	
22	6	50		22	6	30		22	6	32		22	6	42	
23	6	27		23	6	7		23	6	10		23	6	19	
24	6	3		24	5	44		24	5	48		24	5	56	
25	5	40		25	5	21		25	5	24		25	5	32	
26	5	18		26	4	58		26	5	2		26	5	8	
27	4	53		27	4	34		27	4	38		27	4	44	
28	4	31		28	4	10		28	4	14		28	4	21	
29	4	6													

South declination.

South declination.

South declination.

Leap yeare.			First.			Second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
☉	☾	♑	☉	☾	♑	☉	☾	♑	☉	☾	♑
1	3	43	1	3	47	1	3	53	1	3	59
2	3	19	2	3	24	2	3	29	2	3	35
3	2	56	3	3	0	3	3	6	3	3	12
4	2	32	4	2	36	4	2	42	4	2	48
5	2	9	5	2	13	5	2	18	5	2	25
6	1	45	6	1	49	6	1	55	6	2	1
7	1	22	7	1	25	7	1	31	7	1	37
8	0	59	8	1	2	8	1	11	8	1	14
9	0	34	9	0	39	9	0	47	9	0	50
10	0	11	10	0	15	10	0	20	10	0	26
11	0	12	11	0	8	11	0	3	11	0	3
12	0	36	12	0	32	12	0	27	12	0	21
13	0	59	13	0	56	13	0	51	13	0	44
14	1	23	14	1	19	14	1	14	14	1	8
15	1	46	15	1	43	15	1	37	15	1	31
16	2	10	16	2	6	16	2	1	16	1	55
17	2	33	17	2	30	17	2	24	17	2	18
18	2	56	18	2	54	18	2	48	18	2	41
19	3	20	19	3	17	19	3	11	19	3	5
20	3	43	20	3	41	20	3	34	20	3	28
21	4	6	21	4	3	21	3	57	21	3	52
22	4	29	22	4	27	22	4	21	22	4	15
23	4	52	23	4	50	23	4	44	23	4	38
24	5	15	24	5	13	24	5	7	24	5	1
25	5	38	25	5	36	25	5	30	25	5	24
26	6	1	26	5	59	26	5	53	26	5	47
27	6	23	27	6	21	27	6	15	27	6	10
28	6	46	28	6	44	28	6	38	28	6	33
29	7	8	29	7	6	29	7	1	29	6	56
30	7	30	30	7	29	30	7	23	30	7	19
31	7	52	31	7	51	31	7	45	31	7	42

South declination. North declination.

Equinoctiall,

South declination. North declination.

Leap yeare.			First.			Second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	G	♍	D	G	♍	D	G	♍	D	G	♍
1	8	15	1	8	13	1	8	8	1	8	10
2	8	37	2	8	35	2	8	30	2	8	25
3	8	58	3	8	57	3	8	52	3	8	47
4	9	19	4	9	19	4	9	14	4	9	9
5	9	41	5	9	41	5	9	36	5	9	30
6	10	2	9	10	2	6	9	57	6	9	52
7	10	23	7	10	23	7	10	18	7	10	13
8	10	44	8	10	44	8	10	40	8	10	34
9	11	6	9	11	5	9	11	1	9	10	55
10	11	25	10	11	25	10	11	21	10	11	16
11	11	46	11	11	45	11	11	42	11	11	36
12	12	6	12	12	6	12	12	2	12	11	56
13	12	26	13	12	26	13	12	22	13	12	16
14	12	46	14	12	46	14	12	45	14	12	36
15	13	5	15	13	6	15	13	3	15	12	56
16	13	25	16	13	25	16	13	23	16	13	16
17	13	44	17	13	44	17	13	42	17	13	35
18	14	3	18	14	4	18	14	1	18	13	55
19	14	22	19	14	22	19	14	20	19	14	14
20	14	40	20	14	41	20	14	38	20	14	32
21	14	59	21	14	59	21	14	58	21	14	51
22	15	17	22	15	17	22	15	15	22	15	9
23	15	35	23	15	35	23	15	33	23	15	27
24	15	52	24	15	53	24	15	50	24	15	45
25	16	9	25	16	10	25	5	8	25	16	2
26	16	27	26	16	27	26	16	25	26	16	19
27	16	43	27	16	44	27	16	42	27	16	36
28	17	0	28	17	1	28	16	58	28	16	53
29	17	16	29	17	17	29	17	14	29	17	9
30	17	32	30	17	33	30	17	30	30	17	26

North declination. North declination. North declination.

May.

Leap yeare.			First.			Second.			third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
☌	☽	☿	☌	☽	☿	☌	☽	☿	☌	☽	☿
1	17	48	1	17	49	1	17	45	1	17	48
2	18	3	2	17	57	2	18	1	2	18	3
3	18	18	3	18	12	3	18	16	3	18	18
4	18	33	4	18	27	4	18	31	4	18	33
5	18	48	5	18	41	5	18	45	5	18	48
6	19	2	6	18	56	6	19	0	6	19	3
7	19	16	7	19	9	7	19	13	7	19	17
8	19	35	8	19	23	8	19	27	8	19	31
9	19	42	9	19	36	9	19	40	9	19	43
10	19	56	10	19	49	10	19	53	10	19	56
11	20	8	11	20	52	11	20	6	11	20	8
12	20	20	12	20	14	12	20	17	12	20	20
13	20	32	13	20	26	13	20	30	13	20	32
14	20	43	14	20	38	14	20	41	14	20	42
15	20	54	15	20	49	15	20	53	15	20	54
16	21	5	16	21	0	16	21	4	16	21	5
17	21	16	17	21	10	17	21	14	17	21	16
18	21	26	18	21	20	18	21	24	18	21	26
19	21	35	19	21	30	19	21	34	19	21	32
20	21	45	20	21	39	20	21	43	20	21	41
21	21	54	21	21	49	21	21	52	21	21	50
22	22	2	22	21	57	22	22	0	22	21	59
23	22	10	23	22	6	23	22	8	23	22	7
24	22	18	24	22	14	24	22	16	24	22	15
25	22	25	25	22	21	25	22	24	25	22	22
26	22	33	26	22	28	26	22	32	26	22	30
27	22	39	27	22	35	27	22	40	27	22	36
28	22	45	28	22	41	28	22	44	28	22	42
29	22	51	26	22	47	29	22	49	29	22	48
30	22	56	30	22	52	30	22	54	30	22	54
31	23	1	31	22	57	31	22	59	31	22	58

North declination.

North declination.

North declination.

June.

Cap. Care	First.	Second.	Third.
4	1	2	3
1596	1597	1598	1599
1600	1601	1602	1603
1604	1605	1606	1607
1608	1609	1610	1611
1612	1613	1614	1615

☉	☾	♑	☉	☾	♑	☉	☾	♑	☉	☾	♑
1	23	0	1	23	4	1	23	4	1	23	3
2	23	7	2	23	9	2	23	8	2	23	7
3	23	12	3	23	13	3	23	12	3	23	11
4	23	16	4	23	16	4	23	16	4	23	15
5	23	19	5	23	19	5	23	20	5	23	18
6	23	22	6	23	22	6	23	22	6	23	21
7	23	24	7	23	24	7	23	23	7	23	23
8	23	26	8	23	26	8	23	25	8	23	25
9	23	27	9	23	27	9	23	26	9	23	26
10	23	28	10	23	28	10	23	27	10	23	27
11	23	28	11	23	28	11	23	28	11	23	28
12	23	28	12	23	28	12	23	28	12	23	28
13	23	28	13	23	28	13	23	28	13	23	28
14	23	27	14	23	27	14	23	28	14	23	27
15	23	25	15	23	26	15	23	26	15	23	26
16	23	23	16	23	24	16	23	25	16	23	25
17	23	22	17	23	22	17	23	23	17	23	23
18	23	18	18	23	19	18	23	22	18	23	21
19	23	15	19	23	16	19	23	17	19	23	18
20	23	12	20	23	13	20	23	14	20	23	15
21	23	8	21	23	9	21	23	10	21	23	11
22	23	4	22	23	5	22	23	6	22	23	7
23	22	59	23	23	1	23	23	2	23	23	4
24	22	54	24	22	56	24	22	57	24	22	58
25	22	49	25	22	51	25	22	52	25	22	53
26	22	43	26	22	45	26	22	47	26	22	48
27	22	39	27	22	38	27	22	40	27	22	41
28	22	30	28	22	32	28	22	34	28	22	35
29	22	23	29	22	25	29	22	27	29	22	26
30	22	15	30	22	18	30	22	20	30	22	21

North tropick. declination. North tropick. declination. North tropick. declination.

Leap yeare.			First.			Second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	G	M	D	G	M	D	G	M	D	G	M
1	22	12	1	22	10	1	22	14	1	22	21
2	22	4	2	22	2	2	22	4	2	22	6
3	21	56	3	21	54	3	21	56	3	21	58
4	21	47	4	21	45	4	21	47	4	21	49
5	21	3	5	21	35	5	21	38	5	21	40
6	21	28	6	21	26	6	21	28	6	21	30
7	21	19	7	21	16	7	21	19	7	21	21
8	21	2	8	21	6	8	21	6	8	21	11
9	20	52	9	20	55	9	20	58	9	21	0
10	20	42	10	20	44	10	20	47	10	20	49
11	20	29	11	20	33	11	20	36	11	20	38
12	20	17	12	20	21	12	20	24	12	20	26
13	20	5	13	20	9	13	20	12	13	20	14
14	19	52	14	19	57	14	20	0	14	20	6
15	19	41	15	19	44	15	19	47	15	19	49
16	19	27	16	19	31	16	19	34	16	19	36
17	19	13	17	19	17	17	19	20	17	19	23
18	18	59	18	19	4	18	19	7	18	19	10
19	18	45	19	18	48	19	18	53	19	18	56
20	18	31	20	18	35	20	18	38	20	18	43
21	18	16	21	18	21	21	18	24	21	18	28
22	18	1	22	18	6	22	18	9	22	18	13
23	17	47	23	17	51	23	17	54	23	17	58
24	17	30	24	17	35	24	17	38	24	17	42
25	17	14	25	17	19	25	17	23	25	17	26
26	16	58	26	17	3	26	17	6	26	17	11
27	16	42	27	16	47	27	16	50	27	16	55
28	16	25	28	16	30	28	16	33	28	16	38
29	15	8	29	16	13	29	16	17	29	16	21
30	15	51	30	15	56	30	16	0	30	16	4
31	15	33	31	15	39	31	15	42	31	15	47

North declination.

North declination.

North declination.

August.

Leap yeare.			First.			Second.			Third.		
4			1			2			3		
1596			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	G	M	D	G	M	D	G	M	D	G	M
1	15	15	1	15	21	1	15	25	1	15	30
2	14	57	2	15	3	2	15	7	2	15	12
3	14	39	3	14	45	3	14	49	3	14	54
4	14	20	4	14	27	4	14	31	4	14	36
5	14	2	5	14	8	5	14	12	5	14	18
6	13	43	9	13	49	6	13	53	6	13	59
7	13	24	7	13	30	7	13	34	7	13	40
8	13	5	8	13	9	8	13	15	8	13	20
9	12	41	9	12	51	9	12	56	9	13	2
10	12	25	10	12	31	10	12	36	10	12	42
11	12	5	11	12	12	11	12	16	11	12	23
12	11	45	12	11	52	12	11	56	12	12	3
13	11	25	13	11	32	13	11	36	13	11	42
14	11	4	14	11	11	14	11	16	14	11	22
15	10	44	15	10	51	15	10	59	15	11	2
16	10	23	16	10	30	16	10	35	16	10	41
17	10	2	17	10	9	17	10	14	17	10	20
18	9	41	18	9	48	18	9	53	18	9	59
19	9	19	19	9	27	19	9	31	19	9	39
20	8	58	20	9	5	20	9	10	20	9	16
21	8	35	21	8	44	21	8	49	21	8	15
22	8	15	22	8	22	22	8	27	22	8	33
23	7	53	23	8	0	23	8	5	23	8	11
24	7	31	24	7	38	24	7	43	24	7	50
25	7	9	25	7	16	25	7	21	25	7	28
26	6	47	26	6	53	26	6	59	26	7	5
27	6	25	27	6	31	27	6	36	27	6	43
28	6	1	28	6	9	28	6	14	28	6	20
29	5	39	29	5	46	29	5	51	29	5	57
30	5	16	30	5	23	30	5	29	30	5	31
31	4	53	31	5	0	31	5	6	31	5	12

North declination. North declination. North declination.

Leap yeare.	First.	Second.	Third.
4	1	2	3
1596	1597	1598	1599
1600	1601	1602	1603
1604	1605	1606	1607
1608	1609	1610	1611
1612	1613	1614	1615

North declination. Equinoctiall. North declination.

South declination. South declination.

D	G	M	D	G	M	D	G	M	D	G	M
1	4	43	1	4	38	1	4	4	1	4	49
2	4	20	2	4	14	2	4	20	2	4	26
3	3	57	3	3	51	3	3	36	3	4	3
4	3	34	4	3	28	4	3	33	4	3	39
5	3	12	5	3	5	5	3	10	5	3	16
6	2	47	6	2	37	6	2	47	9	2	53
7	2	24	7	2	18	7	2	23	7	2	29
8	2	1	8	1	55	8	2	0	8	2	6
9	1	37	9	1	31	9	1	37	9	1	43
10	1	14	10	1	8	10	1	13	10	1	19
11	0	51	11	0	45	11	0	49	11	0	56
12	0	27	12	0	21	12	0	26	12	0	32
13	0	3	13	0	21	13	0	3	13	0	9
14	0	20	14	0	25	14	0	21	14	0	15
15	0	43	15	0	48	15	0	44	15	0	38
16	1	7	16	1	12	16	1	8	16	1	2
17	1	30	17	1	35	17	1	31	17	1	25
18	1	54	18	1	58	18	1	55	18	1	48
19	2	17	19	2	22	19	2	18	19	2	12
20	2	41	20	2	45	20	2	45	20	2	35
21	3	4	21	3	9	21	3	5	21	2	59
22	3	27	22	3	32	22	3	28	22	3	22
23	3	50	23	3	55	23	3	51	23	3	45
24	4	14	24	4	18	24	4	15	24	4	9
25	4	37	25	4	41	25	4	38	25	4	32
26	5	0	26	5	4	26	5	1	26	4	55
27	5	23	27	5	27	27	5	23	27	5	18
28	5	46	28	5	51	28	5	46	28	5	41
29	6	8	29	6	14	29	6	9	29	6	4
30	6	31	30	6	36	30	6	32	30	6	26

Leap yeare.			First.			Second.			Third.		
4			1			2			3		
1590			1597			1598			1599		
1600			1601			1602			1603		
1604			1605			1606			1607		
1608			1609			1610			1611		
1612			1613			1614			1615		
D	G	♍	D	G	♍	D	G	♍	D	G	♍
1	6	53	1	7	0	1	6	54	1	6	48
2	7	16	2	7	22	2	7	17	2	7	11
3	7	38	3	7	44	3	7	39	3	7	33
4	8	1	4	8	7	4	8	1	4	7	55
5	8	23	5	8	29	5	8	24	5	8	18
6	8	45	6	8	51	6	8	46	6	8	40
7	9	7	7	9	13	7	9	8	7	9	2
8	9	30	8	9	36	8	9	30	8	9	29
9	9	52	9	9	58	9	9	52	9	9	42
10	10	13	10	10	19	10	10	13	10	10	8
11	10	35	11	10	41	11	10	35	11	10	29
12	10	56	12	11	2	12	11	0	12	10	51
13	11	17	13	11	23	13	11	18	13	11	12
14	11	39	14	11	45	14	11	39	14	11	33
15	11	59	15	12	5	15	12	0	15	11	54
16	12	20	16	12	26	16	12	21	16	12	15
17	12	41	17	12	47	17	12	41	17	12	36
18	13	1	18	13	7	18	13	1	18	12	56
19	13	21	19	13	27	19	13	22	19	13	17
20	13	41	20	13	47	20	13	41	20	13	36
21	14	1	21	14	6	21	14	1	21	13	56
22	14	17	22	14	26	22	14	21	22	14	16
23	14	39	23	14	45	23	14	40	23	14	35
24	14	58	24	15	4	24	14	59	24	14	54
25	15	17	25	15	23	25	15	17	25	15	13
26	15	35	26	15	41	26	15	36	26	15	31
27	15	54	27	15	59	27	15	54	27	15	50
28	16	12	28	16	17	28	16	12	28	16	8
29	16	29	29	16	35	29	16	30	29	16	25
30	16	47	30	16	52	30	16	47	30	16	43
31	17	4	31	17	9	31	17	4	31	17	0

South declination.

South declination.

South declination.

Leap veare.				First.				Second.				third.			
4				1				2				3			
1596				1597				1598				1599			
1600				1601				1602				1603			
1604				1605				1606				1607			
1608				1609				1610				1611			
1612				1613				1614				1615			
☽	☉	☿		☽	☉	☿		☽	☉	☿		☽	☉	☿	
1	17	3		1	17	26		1	17	21		1	17	17	
2	17	5		2	17	42		2	17	38		2	17	33	
3	18	2		3	17	58		3	17	54		3	17	49	
4	18	5		4	18	14		4	18	9		4	18	6	
5	18	41		5	18	29		5	18	25		5	18	22	
6	18	57		6	18	44		6	18	40		6	18	37	
7	19	13		7	18	59		7	18	55		7	18	52	
8	19	29		8	19	14		8	19	10		8	19	6	
9	19	45		9	19	26		9	19	24		9	19	21	
10	19	52		10	19	42		10	19	36		10	19	35	
11	20	5		11	19	55		11	19	52		11	19	48	
12	20	18		12	20	8		12	20	5		12	20	4	
13	20	30		13	20	21		13	20	18		13	20	14	
14	20	43		14	20	34		14	20	30		14	20	27	
15	20	54		15	20	46		15	20	42		15	20	39	
16	21	6		16	20	57		16	20	54		16	20	51	
17	21	17		17	21	8		17	21	5		17	21	3	
18	21	27		18	21	19		18	21	16		18	21	14	
19	21	37		19	21	29		19	21	27		19	21	24	
20	21	47		20	21	39		20	21	37		20	21	35	
21	21	56		21	21	49		21	21	47		21	21	44	
22	22	5		22	21	58		22	21	56		22	21	54	
23	22	14		23	22	7		23	22	5		23	22	3	
24	22	21		24	22	15		24	22	14		24	22	11	
25	22	29		25	22	23		25	22	24		25	22	19	
26	22	36		26	22	31		26	22	29		26	22	27	
27	22	43		27	22	38		27	22	37		27	22	34	
28	22	49		28	22	44		28	22	43		28	22	41	
29	22	55		29	22	50		29	22	49		29	22	47	
30	23	0		30	22	56		30	22	54		30	22	53	

South declination. South declination. South declination

December.

Leap yeare	First.	Second.	Third
4	1	2	3
1596	1597	1598	1599
1600	1601	1602	1603
1604	1605	1606	1607
1608	1609	1610	1611
1612	1613	1614	1615

D	G	M		D	G	M		D	G	M		D	G	M
1	23	1		1	23	1		1	23	0		1	23	1
2	23	10		2	23	6		2	23	5		2	23	10
3	23	14		3	23	10		3	23	9		3	23	14
4	23	17		4	23	14		4	23	13		4	23	17
5	23	20		5	23	17		5	23	17		5	23	19
6	23	22		9	23	20		6	23	20		6	23	21
7	23	25		7	23	23		7	23	22		7	23	24
8	23	26		8	23	25		8	23	25		8	23	26
9	23	27		9	23	26		9	23	26		9	23	27
10	23	28	South	10	23	27	South	10	23	27	South	10	23	28
11	23	28	tropick	11	23	28	tropick	11	23	28	tropick.	11	23	28
12	23	28		12	23	28		12	23	28		12	23	28
13	23	27	declination.	13	23	28	declination.	13	23	28	declination.	13	23	27
14	23	26		14	23	27		14	23	27		14	23	26
15	23	24		15	23	26		15	23	26		15	23	24
16	23	21		16	23	24		16	23	24		16	23	21
17	23	18		17	23	21		17	23	22		17	23	18
18	23	15		18	23	19		18	23	20		18	23	15
19	23	12		19	23	16		19	23	17		19	23	12
20	23	8		20	23	12		20	23	13		20	23	8
21	23	6		21	23	8		21	23	7		21	23	5
22	22	57		22	23	3		22	23	4		22	22	57
23	22	52		23	22	58		23	22	59		23	22	53
24	22	46		24	22	52		24	22	54		24	22	46
25	22	40		25	22	47		25	22	48		25	22	40
26	22	33		26	22	40		26	22	42		26	22	33
27	22	25		27	22	36		27	22	35		27	22	25
28	22	18		28	22	30		28	22	28		28	22	18
29	22	9		29	22	22		29	22	20		29	22	9
30	22	0		30	22	14		30	22	12		30	22	0
31	21	52		31	22	6		31	22	4		31	21	52

Howe to vse the Suns Declination, for knowing the eleuation of the Pole.

FIrst learne whether the Sunne haue South Declination, or North Declination. Then marke the shadow hee giueth, whether it shewe towardes the Pole he is nerest, or to the contrary.

If the Sunne giue shadow, the same way that he is from the Equinoctiall, hee shall bee betweene you and the Equinoctiall, then take the meridian altitude, and subtract it from 90. vnto the rest, adioyne your Declination for the day, the Sunne of both is the eleuation of the Pole, or your distance from the Equinoctiall.

But if the Sun giue the shadowe to the contrarie side of the Equinoctiall that hee is in (that is to say) the Sunne in North Declination giue the shadowe Southwardes, or in South Declinations giue the shadowe Northwardes, then either the Equinoctiall shalbee betweene you and the sun, or you in the Equinoctiall, or els you shall bee betweene the Equinoctiall and the sun, which you shall thus know.

Adde vnto your Meridian altitude of the sunne, the Declination for the day, if it amount to lesse then 90. d. by much as wanteth of 90. d. you shall be from the Equinoctiall that way that the shadow goeth.

But if it amount iust to 90. d. you shall be vnder the Equinoctiall. If it amount to more then 90. d. so much as is ouer and aboue 90. d. you shalbee from the Equinoctiall towardes the sun, betweene the Equinoctiall and the sun.

And if at any time you shall obserue the suns altitude in your Zenith, then looke what declination it hath, and so much shall you be from the Equinoctiall, on the same side the sunne is in, but if he haue no Declination, then you shall be vnder the Equinoctiall line.

Hereafter followeth three Tables, the first is of the Coniunctions of the sunne and Moone: the second of their oppositions, exactly drawen out of Iohannes Stadius Ephemerides: and the third of the Prime and mooueable Feastes.

IN the two first Tables in euery square of euery Cullum, you shall finde noted, three numbers, which haue seuerall significations: the first number is for the date of the Moneth, the second for houres, and the third for minutes, of the middle instant of time, for the coniunction or oppolition of the Sunne and Moone.

We are to note that the naturall day accounted in these tables, beginneth alwaies at the instant of noone, or midday, and continueth till the next day noone, which is the iust time of 24. houres.

Therefore, when you finde the seconde number in ante square of the two first Tables, to exceede 12. the same is to be accounted with the minutes following, (which is the thirde number) for so much after midnight, or of the morning, or fore noone of the next day.

The vse of the Tables.

FIrst seeke in the third Table the Prime, conuenable to the yeare of our Lorde: then returne to the Table of Coniunction, or oppolition of the Moone, and in the first cullum seeke the same number of the Prime. Then in the head of the Table, you shall seek the Moneth, for

for which you desire to knowe the coniunction or apposition: and descending downe the same Cullum, till you come against the Prime specified, in that square you shall finde three numbers noted, the first is for the day of the moneth, the second the houre, and the thirde the minutes to bee adioyned with the houre, for the middle instant of tyme of the coniunction or apposition.

Example.

This yeare 1581. I desire to knowe the day of the Moones Coniunction or Change, in the Moneth of August, I seeke in the third Table (or Table of the moueable Feasts) for the Prime, and finde it to be 5. with which number I returne vnto the first Table, (which is the Table of the coniunction or change) and find the same in the first Cullum. Then I seeke in the head of the Table for August, and descending downe in the same Cullum, till I come to the square which answereth to the Prime 5. I finde therein noted 28——16——45. which signifie that the coniunction is the 28. day of the Moneth, at 16. H——45. M——and because the seconde number exceedeth 12. therefore I say that the coniunction shall bee the 29. day at 4. H——45——M. in the morning.

But if you find in any one square three numbers double noted, they doo signifie, that in the same Moneth there is two coniunctions or appositions, and likewise doo shewe the dayes, houres, and minutes thereof.

If in any square in the Cullum of any moneth in the Table of Coniunction, you finde noted this marke *. the same doth signifie the Ecclipse of the Sunne at the instant of time noted for the coniunction in that moneth.

Likewise, if in any square in the Table of the oppositions or ful Moones, you finde this marke ☾ the same doth signifie the eclipse of the Moone, at the instant of tyme noted in the same square.

Prime.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	18	17	18	16	16	30	15	14	13	11	11	9	8
1	22	16	6	12	14	22	3	19	6	17	3	13	23
	10	0	0	40	20	28	0	30	40	20	20	18	40
	7	5	7	6	5		4	3	2	1	30	28	28
2	11	23	12	3	17		8	23	13	3	4	15	2
	10	28	50	11	50		40	30	50	40	30	49	30
	26	24	26	24	24		23	22	21	19	19	18	17
3	12	23	10	22	10		0	15	7	23	14	5	17
	53	10	19	5	50		40	48	24	12	50	3	50
	16	14	16	14	13		12	11	10	9	8	7	7
4	5	14	0	9	10		5	17	8	0	17	11	4
	0	50	0	1	30		20	48	10	16	50	30	6
	5	4	4	3	2	21	30	29	28	26	26	25	15
5	18	6	16	1	8	16	1	12	1	17	12	7	1
	20	50	40	6	4	30	20	30	50	50	8	14	40
	23	22	23	22	21		19	18	17	15	15	14	14
6	17	7	17	1	9		15	23	9	21	12	6	2
	50	10	30	50	1		50	38	14	25	45	47	21
	12	11	13	11	11		9	8	6	5	4	3	3
7	21	15	5	17	1		9	16	23	8	19	11	2
	30	0	30	0	50		20	8	23	5	12	25	16
	1	31	2	1	30	30	28	27	26	24	23	22	21
8	21	16	10	1	14	0	9	16	0	8	19	7	83
	10	20	10	40	20	30	0	25	9	40	3	54	13
	26	19	20	18	18		6	16	14	13	12	10	10
9	16	16	3	19	9		1	7	16	1	10	20	8
	30	30	50	50	40		30	41	42	25	24	39	10
	8	7	9	7	7		6	5	4	2	2	31	29	29
10	21	12	4	20	12		3	16	4	16	2	12	22	9
	30	40	40	50	30		10	18	50	4	29	38	50	48

1736
1
19) 1737 (91
171
27
19
Golden Number

1736
9
28) 1745 (62
168
65
56
Cycle of the Sun

1736
3
15) 1737 (115
15
23
15
8
Roman Indict

Day
the
the

I find the Golden Number Cycle of the Sun and Roman Indiction thus. 1736 to the year has added ten Dionysius 9. 28. 15. as you see in the example above for the year 1736. which is 9. Cycle.

Prime.	Januarie.	Februarie.	March.	Aprill	May.	June.	July.	August.	September.	October.	Nouember.	December.
	27	29	27	26	26	24	24	23	21	21	19	19
11	21	10	23	13	4	19	10	0	14	2	14	1
	20	0	30	50	30	20	12	33	8	56	42	42
	17	15	16	15	15	13	13	11	10	9	8	7
12	15	23	22	10	23	17	8	21	10	21	9	20
	11	40	10	25	30	24	12	50	50	30	38	12
	6	4	6	4	4	2	2	30	29	28	27	26
13	6	16	3	15	3	18	8	15	6	21	9	21
	30	50	30	40	3	18	19	20	30	0	46	24
	25	23	25	23	22	21	20	19	18	17	19	10
14	8	18	5	13	23	11	23	15	8	23	18	9
	40	30	40	40	3	50	36	50	20	48	30	50
	14	13	14	13	12	10	10	8	7	6	5	5
15	22	10	20	2	12	21	6	18	9	23	20	14
	30	50	0	30	50	30	30	45	22	50	24	48
	4	2	3	1	30	28	28	26	25	24	23	23
16	9	23	11	21	12	20	4	14	4	20	14	10
	17	40	55	20	32	17	3	40	0	12	30	8
	22	20	22	20	20	18	17	15	14	13	12	12
17	5	21	10	21	5	13	20	23	10	23	13	8
	39	25	50	25	40	6	30	50	47	50	55	32
	11	9	11	10	9	8	7	5	3	3	1	1 31
18	5	23	18	8	20	5	12	20	23	10	20	10 4
	37	40	10	4	3	32	20	0	50	50	56	30 30
	29	28	30	27	28	26	26	24	23	22	20	20
19	23	18	11	23	15	23	12	20	4	12	22	10
	12	42	50	30	38	50	0	30	6	3	30	36

Day of the month
the hour
and the minit.

and so of all y
rest as they stand
under their proper
ive months as
written on the to
of each Column.

June.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November	December.
	5	3	3	2	1 30	29	28	27	25	25	24	24
1	10	11	22	☾7	15 22	7	18	6	21 ☾	14	9	5
	14	32	40	8	0 38	58	0	0	2	30	50	9
	22	21	23	21	20	19	18	16	15	14	13	13
2	22	13	1	10	17	0	7	16	2☾	16	9	4
	48	10	10	1	30	20	30	4	50	50	40	48
	12	10	12	10	10	8	8	6	4	4	2	2
3	0	18	10	23	9	17	0	7	15	1	14	6
	24	50	32	20	20	30	43	50	50	50	30	12
	1 30		1 31	29	29	27	27	25	23	23	21	21
4	0 19 ☾		13 5	19	7	16	0	8	16	2	14	4
	4 6		0 30	30	3	30	49	40	40	42	22	17
	19	18	19	17	17	16	15	14	12	11	10	9
5	20 ☾	30	6	22	30	2	14 ☾	0	9	18	4	15
	15	20	30	30	30	30	1	13	36	50	40	40
	8	6	8	6	6	5	4	3	1	1 30	29	28
6	3 ☾	17	8	23	15	6	20	9	22	9 20	7	18
	50	30	20	40	0	10	30	50	23	50 50	38	1
	27	25	27	25	25	23	23	22	20	20	18	18
7	6	16	4	17	7	19	13	4	19	9	22	10
	30	10	0	30	30	50	5	17	7	15	15	0
	16	15	16	15	14	13	12	11	9	9	8	7
8	20	6	16	1	12	0	14	5	21	14	7	22
	30	20	0	50	40	40	21	30	50	47	34	30
	6	4	5	3	3	1	30	28	27	27	26	25
9	11	22	8	16	0	9	7	22	15	9	4	21
	40	50	10	30	40	30	51	27	26	25	9	29
	24	23	24	22	22	20	19	18	16	16	15	14
10	12	0	9	17	0	7	16	3	17	9	4	23
	0	9	40	20	20	[illegible]	[illegible]	[illegible]	5	26	12	47

Iesus Nazarenus Rex Iudæorum

	Ianuarie.	Februarie.	March.	April.	May.	Iune.	Iuly.	August.	September.	October.	November.	December.
	13	2	13	12	11	10	9	7	6	5	4	3
11	18	10	23	9	17	0	7	15	10	13	5	3
	20	30	30	40	50	40	8	21	0	26	0	10
	3	2	2	1 30	29	28	27	25	24	23	20	22
12	10	5	18	5 13	21	3	12	21	9	23	18	13
	8	25	40	20 50	19	0	18	40	50	36	20	30
	21	19	21	20	19	17	17	15	13	13	11	11
13	8	23	16	3	33	1	2	11	20	0	20	12
	50	0	30	30	10	40	30	25	12	50	30	50
	10	9	10	9	8	7	6	5	3	2	1 30	30
14	8	3	21	12	23	12	20	4	12	20	6 19	9
	6	20	5	40	50	13	20	11	9	50	35 0	50
	18	17	29	28	27	26	25	24	22	21	20	19
15	23	21	14	7	21	9	19	4	19	22	88	19
	30	22	37	0	7	25	12	30	30	30	7	34
	18	16	17	16	15	14	14	12	10	10	8	8
16	9	23	15	7	23	3	2	16	23	14	23	10
	36	36	27	35	25	36	30	8	50	30	30	30
	6	5	6	5	4	3	3	1 31	29	29	27	27
17	22	9	20	10	23	15	4	20 10	23	13	23	12
	12	17	11	38	50	25	35	48 30	30	36	50	12
	25	24	25	24	23	22	21	20	19	18	17	16
18	23	10	20	7	19	8	21	12	4	22	12	23
	50	12	13	13	25	11	30	30	8	16	16	50
	15	14	5	13	13	11	10	9	8	7	4	6
19	15	7	11	20	5	14	23	12	5	22	16	10
	6	34	30	12	9	53	30	50	30	30	30	8

Heere followeth an Almanacke, whereby may bee knowne the Prime, Epact & Dominicall letter: as also the moueable Feastes for 24. yeares to come. Which Almanacke is to be referred to the Kalender in the beginning of the booke.

Anno Domini.	The prime.	The Epact.	The Sunday letter.	Easter daies.	Rogation Sunday.	Ascention day.	Whitsonday.	Betwixt Whitsontide and Midsommer. week.	daie
1596	1	11	D C	11. Aprill.	16. May.	20. May.	30. May	3.	4
1597	2	22	B A	27. March.	1. May.	5. May.	15. May.	5.	5
1598	3	3	G F	16. April.	21. May.	25. May.	4. Iune.	2.	6
1599	4	14	E D	8. April.	13. May.	17. May.	27. May.	4.	0
1600	5	25	C B	23. March.	27. April	1. May.	11. May.	6.	2
1601	6	6	A G	12. April.	17. May.	21. May.	31. May.	3.	3
1602	7	17	F E	4. Aprill.	9. May.	12. May.	23. May.	4.	4
1603	8	28	D C	24. Aprill.	29. May.	2. Iune.	12. Iune.	1.	5
1604	9	9	B A	8. April.	13. May.	17. May.	27. May.	4.	0
1605	10	20	G F	31. March	5. May.	9. May.	19. May.	5.	1
1606	11	1	E D	20. April.	25. May.	29. May.	8. Iune.	2.	2
1607	12	12	C B	5. April.	10. May.	14. May.	24. May.	4.	3
1608	13	23	A G	27. March.	1. May.	5. May.	15. May.	5.	5
1609	14	4	F E	16. April.	21. May.	25. May.	4. Iune.	2.	6
1610	15	15	D C	1. April.	6. May.	10. May.	20. May.	5.	0
1611	16	26	B A	24. March.	28. April	2. May.	12 May.	6.	1
1612	17	7	G F	12. Aprill.	17. May.	21. May.	31. May.	3.	3
1613	18	18	E D	4. Aprill.	9. May.	13. May.	23. May.	4.	4
1614	19	29	C B	7. April.	22. May.	26. May.	5. Iune.	2.	5
1615	1	11	A G	9. April.	14. May.	18. May.	28. May.	3.	6
1616	2	22	F E	31. March	5. May.	9. May.	19. May.	5.	1
1617	3	3	D C	13. April.	18. May.	22. May.	1. Iune.	3.	2
1618	4	14	B A	5. April.	10. May.	14. May.	24. May	4.	3
1629	5	25	G	28. March.	2. May.	6. May.	15. May.	5.	4

The contents of the Kalender following.

In the first and second Cullum, vnder the title daies, are the daies of the moneth, & dominicall letters, the third is of the feasts: the fourth cullum sheweth howe manie houres and minutes the day containeth from Sun rising to Sun setting, the Pole being eleuated 52. degrees. The fifth cullum of the 27. letters serueth with the help of a Table following, to know what signe the Mone is in at all times.

How by the length of the day is knowen the length of the night, with the houre and minute of the Sunnes rising and setting.

Deuide the length of the day, which you shall finde in the Kalender, into two partes equally, the one halfe sheweth the houres and minutes of the Suns setting, the houres and minutes of the setting, being subtracted from 12. the remaine sheweth the houres and minutes of the rising: the whole arke or length of the day, beeing subtracted from 24 the rest sheweth the length of the night (that is to say) from Sunne setting to Sunne rising.

As for example.

The 15. of January, I finde in the Kalender the length of the day to be 8. houres 30 minutes, which beeing deuyded the halfe thereof is 4. houres. 15. minutes. the Sunnes setting that day: this 4. houres, 15. minutes, subtracted from 12. resteth 7. houres, 45. minutes, which is the houre of the Sunnes rising: subtract 8. houres. 30. minutes, the whole length of the day, out of 24. rest 15. houres, 30. minutes, which is the length of the night that day of the moneth.

The

Dayes.		Ianuary.	Length of the daies. ☽			Dayes.		Februury.	Length of the day. ☾		
1	A	New yeres day	7	25	b	1	d	Fast.	9	28	e
2	b	Octa. Stephen.	7	55	a	2	e	Purifi. of Mary	9	32	f
3	c	Octa. John.	7	58	c	3	f	Blase. Martyr	9	36	g
4	d	Octa. Innocēt.	8	0	d	4	g	Gilbert confes.	9	40	h
5	e	Depo. of Edw	8	3	e	5	a	Agathe virgin	9	44	i
6	f	Twelfe day.	8	6	f	6	b	Dorothe Mar.	9	49	k
7	g	Felix & Janu.	8	8	g	7	c	Angalle.	9	52	l
8	A	Lucian Priest	8	11	h	8	d	Sallomon.	9	56	m
9	b	Joyce Virgin.	8	14	i	9	e	Sol in Pisces.	10	0	n
10	c		8	16	k	10	f	Scollastica.	10	4	o
11	d	Sol in Aquar:	8	18	l	11	g	Dother Bishop	10	8	p
12	e	Atlas.	8	20	m	12	A	Eufrase virgin	10	10	q
13	f	Hillarie Bish	8	24	n	13	b		10	14	r
14	g	Felicia.	8	26	o	14	c	Valentine.	10	18	s
15	A	Maurice.	8	30	p	15	d		10	22	s
16	b	Marcell.	8	33	q	16	e	Julian virgin.	10	20	t
17	c	Depo. of Anth.	8	36	r	17	f	Germaine.	10	30	v
18	d	Prisca Virgin	8	40	s	18	g	Hugh Bishop	10	34	u
19	e	Wolstane bish	8	43	s	19	A	Simeon.	10	38	x
20	f	Fabian & Seb.	8	42	t	20	b	Wilfred.	10	42	y
21	g	Agnes Virgin	8	50	u	21	c	Lxxii. Martirs	10	46	z
22	A	Vincent mart.	8	52	v	22	d	Peters chaires	10	50	&
23	b	Timothe.	8	56	x	23	e	Fast.	10	54	ſt
24	c	Emerite.	9	0	y	24	f	Mathie Apost.	10	58	a
25	d	Conu. of Paule.	9	4	z	25	g	Inuent. Poule	11	2	b
26	e	Policarp. mar.	9	6	&	26	A	Nestor.	11	7	c
27	f	Thrisost, doctor	9	10	ſt	27	b	Alexander.	11	12	d
28	g	Theodor priest	9	14	a	28	c	Augustine.	11	16	e
29	A	Valerie bishop	9	18	b						
30	b	Bateld queene	9	22	c						
31	c	Saturn & Vict	9	26	d						

Daies.	March.	Length of the daies.	☾
1 d	Dauid.	11 24	f
2 e	Chadde.	11 28	g
3 f	Maurice.	11 32	a
4 g	Adrian.	11 36	b
5 A	Focas & Eule.	11 40	c
6 b	Uict & Uenin.	11 44	d
7 c	Perpetue.	11 48	e
8 d	Depo. of Felix	11 52	f
9 e	Forty martirs	11 56	g
10 f	Agapit.	12 0	a
11 g	Sol in Aries	12 4	b
12 A	Gregorie bish	12 8	c
13 b	Theodore.	12 12	d
14 c	Candide.	12 16	e
15 d	Longine.	12 20	f
16 e	Vilia & Jonas	12 24	g
17 f	Gertude.	12 28	a
18 g	Edward king.	12 32	b
19 A	Jose. Ma hul.	12 36	c
20 b	Cutbert.	12 40	d
21 c	Benedict.	12 44	e
22 d	Afrodose.	12 48	f
23 e	Theodore.	12 52	g
24 f	Fast.	12 58	a
25 g	Annũ of Mar	13 2	b
26 A	Taftor martir	13 9	c
27 b	Perciany.	13 10	d
28 c	Rupert.	13 14	e
29 d	Victorine.	13 18	f
30 e	Quirine.	13 22	g
31 f	Adelme.	13 26	a

Daies.	Aprill.	Length of the day.	☽
1 g	Gilbard.	13 30	b
2 A	Marie Egipt.	13 34	c
3 b	Richard Bish.	13 38	d
4 c	Ambrose.	13 42	e
5 d	Vincent.	13 46	f
6 e	Sextus.	13 50	g
7 f	Euphemy.	13 52	a
8 g	Dionisius.	13 56	b
9 a	Perpetuus.	14 0	c
10 b	Apolinia.	14 2	d
11 c	Sol in Taurus.	14 4	e
12 d	Sother.	14 8	f
13 e	Marcus.	14 12	g
14 f	Liburtie.	14 16	a
15 g	Osmond.	14 20	b
16 A	Isidore.	14 24	c
17 b	Anisette.	14 28	d
18 c	Elutherius.	14 32	e
19 d	Alphege.	14 34	f
20 e	Victor.	14 38	g
21 f	Simion.	14 42	a
22 g	Sother.	14 46	b
23 A	George Mart	14 50	c
24 b	Milfride.	14 54	d
25 c	Marke Euang.	14 56	e
26 d	Clete.	15 0	f
27 e	Anastatius.	15 4	g
28 f	Vitales.	15 8	a
29 g	Peter of Ma.	15 10	b
30 A	Dep. of Erken	15 14	c

Dayes.		May.	Length of the daies.		☽
1	b	Philip & Iacob.	15	18	n
2	c	Athanasius.	15	20	o
3	d	Inu. of ỳ crosse.	15	24	p
4	e	Christopher.	15	28	q
5	f	Godarde.	15	30	r
6	g	Iohn Port Lat.	15	32	s
7	A	Iohn of Beuer.	15	34	t
8	b	Aper. of Micha.	15	36	u
9	c	Transl. of Nic.	15	40	u
10	d	Gordian.	15	42	y
11	e	Anthony.	15	44	z
12	f	Sol in Gemini	15	46	A
13	g	Seruatius.	15	49	B
14	A	Boniface mart.	15	52	C
15	b	Isidore.	15	54	D
16	c	Discoz. Mart.	15	57	a
17	d	Dunstane.	16	0	b
18	e	Bernardine.	16	2	c
19	f	Aquilla.	16	5	d
20	g	Dunstone.	16	8	e
21	A	Barnardine.	16	10	f
22	b	Helenaquene.	16	12	g
23	c	Desiderii.	16	14	h
24	d	Serule.	16	15	i
25	e	Urbane.	16	16	k
26	f	Adelme confess.	16	18	l
27	g	Bede Priest.	16	19	m
28	A	Germaine.	16	20	n
29	b	Cozone.	16	21	o
30	c	Felix.	16	22	p
31	d	Petronill.	16	23	q

Dayes.		Iune.	Length of the day.		☾
1	e	Nicomede.	16	24	r
2	f	Marcell.	16	25	s
3	g	Erasmus.	16	26	s
4	A	Petrocus.	16	27	t
5	b	Boneface.	16	28	v
6	c	Melon.	16	28	u
7	d	Paule Bishop	16	29	x
8	e	Trãs. of Edm.	16	30	y
9	f	Ianus, confess.	16	30	z
10	g	Trã of Wolst.	16	30	z
11	A	Barnard Apo.	16	30	A
12	b	Sol in Cancer.	16	30	a
13	c	Anthonie.	16	30	b
14	d	Basilides.	16	30	c
15	e	Vite and Mode	16	29	d
16	f	Tran of Rich.	16	28	e
17	g	Botulphe.	16	28	f
18	A	Mar. & Marcel.	16	27	g
19	b	Gervasius.	16	27	h
20	c	Tran. of Edw.	16	26	i
21	d	Walburge.	16	25	k
22	e	Albyne.	16	24	l
23	f	Fast.	16	23	m
24	g	Iohn Baptist.	16	22	n
25	A	Amandi.	16	20	o
26	b	Iohn & Paule.	16	19	p
27	c	Crescence.	16	18	q
28	d	Fast	16	16	r
29	e	Peter & Paule.	16	15	s
30	f	Com. of Pauls.	16	14	t

Daies.	Iulie.	Length of the daie. ☽			Daye.	August.	Length of the daie. ☽		
1	g	Octa of Iohn.	16	12	f	1	c	Lamas.	14	46	y
2	A	Visit of Marie	16	10	g	2	d	Stephen.	14	42	z
3	b	Trã of Thom	16	8	a	3	e	Invent. Ste.	14	38	A
4	c	Tran of Mart.	16	5	b	4	f	Iustine.	14	34	B
5	d	CCC virgins	16	3	c	5	g	Festũ Nivis.	14	32	a
6	e	Martalis.	16	2	d	6	A	Trãsfi. of Chr	14	28	b
7	f	Zenane mart	16	0	e	7	b	Feast of Iesus	14	24	c
8	g	Depo. of Grem	15	57	f	8	c	Ciriacke.	14	20	d
9	A	Cyrile Bishop	15	54	g	9	d	Roman mart	14	16	e
10	b	Dog daies begin	15	52	A	10	e	Laurence mar.	14	12	f
11	c	Seuen brethré	15	49	b	11	f	Cutbert.	14	8	g
12	d	Nabor & Felix.	15	49	c	12	g	Clarie.	14	4	A
13	e	Sol in Leo.	15	46	d	13	A	Yiplit.	14	0	b
14	f	Reuell.	15	42	e	14	b	Sol in Virgo.	14	56	c
15	g	Transl. Swith	15	40	f	15	c	Assump. Marie	13	52	d
16	A	Trãs. Osmõd.	15	37	g	16	d	Roch mart.	13	50	e
17	b	Katherine.	15	34	A	17	e	Octa Laurenci	13	46	f
18	c	Arnulfe.	15	30	b	18	f	Lewis.	13	42	g
19	d	Rustan & Iust.	15	28	c	19	g	Warnerd.	13	38	A
20	e	Margaret.	15	24	d	20	A	Dog daies end	13	34	b
21	f	Mared.	15	20	e	21	b	Prinate.	13	30	c
22	g	Marie Magde.	15	18	f	22	c	Timothe.	13	26	d
23	A	Apolinarie.	15	14	g	23	d	Fast.	13	22	e
24	b	Fast.	15	10	A	24	e	Barthol Apost.	13	18	f
25	c	Iames Apostle.	15	8	b	25	f	Lewes King.	13	14	g
26	d	Anne mot. Ma.	15	4	c	26	g	Seuerne.	13	10	A
27	e	Vii. Sleepers.	15	0	d	27	A	Rufine Martin	13	8	b
28	f	Sampson.	14	58	e	28	b	Augustine bish	13	6	c
29	g	Martha.	14	56	f	29	c	John beheded.	13	2	d
30	A	Abdon & Sen.	14	54	g	30	d	Felix & Audact.	12	58	e
31	b	German.	15	50	A	31	e	Cuthburg	12	54	f

Dates.		September.	Length of the daie.	☽		Daye.		October.	Length of the daie.	☽	
1	f	Giles.	12	48	a	1	a	Remigius.	10	46	d
2	g	Anthony mar.	12	44	b	2	b	Leodegarie.	10	42	e
3	a	Lupus Bishop.	12	40	c	3	c	Candide.	10	38	f
4	b	Transl. Cuthb.	12	36	d	4	d	Frances.	10	34	g
5	c	Bertine,	12	32	e	5	e	Apoline.	10	30	a
6	d	Eugenius.	12	28	f	6	f	Faith.	10	26	b
7	e	Nati. Eliz. Reg.	12	24	g	7	g	Martine.	10	22	c
8	f	Natiu. of Mari.	12	20	a	8	a	Pelagius.	10	18	d
9	g	Gorgonie.	12	16	b	9	b	Gercon & Vic.	10	14	e
10	a	Siluius Bish.	12	12	c	10	c	Nicasius.	10	10	f
11	b	Protec, & Hil.	12	8	d	11	d	Edward King.	10	6	g
12	c	Martinian.	12	4	e	12	e	Adorant.	10	4	a
13	d	Sol in Libra.	12	0	f	13	f	Calictes.	10	0	b
14	e	Holie Crosse.	11	56	g	14	g	Sol in Scorpio.	9	56	c
15	f	Nicetus.	11	52	a	15	a	Wolfran.	9	52	d
16	g	Edith.	11	48	b	16	b	Mich of ꝑ mou	9	48	e
17	a	Lambert.	11	44	c	17	c	Etheldred.	9	44	f
18	b	Vict. and Cor.	11	40	d	18	d	Luke Euangel.	9	40	g
19	c	Januarie mar.	11	36	e	19	e	Frodeswide	9	36	a
20	d	Fast.	11	32	f	20	f	Austerbert.	9	32	b
21	e	Mathew Apo.	11	28	g	21	g	V. M. Virgins	9	28	c
22	f	Maricius.	11	24	a	22	a	Mary Salom.	9	26	d
23	g	Tecla Virgin	11	20	b	23	b	Romaine.	9	22	e
24	a	Andochius.	11	16	c	24	c	Maglorie.	9	18	f
25	b	Fermine.	11	12	d	25	d	Crispine.	9	14	g
26	c	Dipri. & Iust.	11	6	e	26	e	Ursula.	9	10	a
27	d	Cosme & Da.	11	2	f	27	f	Fast.	9	6	b
28	e	Ereuperius.	10	58	g	28	g	Simon & Iude.	9	4	c
29	f	Michael Arch.	10	54	a	29	a	Narcisus.	9	0	d
30	g	Hierome priest	10	50	b	30	b	Berman.	8	56	e
						31	c	Fast.	8	52	f

Dayes.		Nouember.	Length of the dayes.		
1	d	All Saints.	8	50	h
2	e	All Soule.	8	46	i
3	f	Wenefride.	8	42	k
4	g	Amantius.	8	40	l
5	A	Lets Priest.	8	36	m
6	b	Leonard.	8	32	n
7	c	Wilbrode.	8	30	o
8	d	Foure crown.	8	26	p
9	e	Theodore.	8	24	q
10	f	Benet.	8	20	r
11	g	Martine Bish	8	18	s
12	A	Paterne.	8	16	t
13	b	Sunne in Sagit	8	14	u
14	c	Tran. Erken.	8	11	u
15	d	Pachute.	8	8	v
16	e	Dep. Edmond	8	6	x
17	f	Init. Reg. Eliz.	8	3	y
18	g	Octa Marie.	8	0	z
19	A	Eliza Martir.	7	58	&
20	b	Edmond king.	7	55	A
21	c	Present. Ma.	7	52	B
22	d	Cecill virgin.	7	50	C
23	e	Clement.	7	47	D
24	f	Grisogon.	7	45	E
25	g	Katherine.	7	44	F
26	A	Line.	7	42	G
27	b	Agricola.	7	41	H
28	c	Rufus martir	7	40	I
29	d	Satu. ☾ Fast	7	38	K
30	e	Andrew Apo.	7	37	L

Dayes.		December.	Length of the day.		☾
1	f	Elegius.	7	36	l
2	g	Libane.	7	35	m
3	A	Dep. Osmond	7	34	n
4	b	Barbara.	7	33	o
5	c	Sava.	7	32	p
6	d	Nicholas bish.	7	32	q
7	e	Ambrose.	7	21	r
8	f	Conc. of Mary	7	30	s
9	g	Cipzian.	7	30	s
10	A	Eulalia.	7	30	t
11	b	Damase.	7	30	u
12	c	Sun in Capric.	7	30	u
13	d	Luce virgin.	7	30	x
14	e	Nicasius bish.	7	30	y
15	f	Valerius.	7	31	z
16	g	Lazarus con.	7	32	&
17	A	Osapientie.	7	32	A
18	b	Gracian.	7	33	B
19	c	Venesia. Vir.	7	34	C
20	d	Fast.	7	35	D
21	e	Thomas Apo.	7	36	E
22	f	xxx. Martirs	7	37	F
23	g	Victor.	7	38	G
24	A	Fast.	7	40	H
25	b	Christmas day	7	41	I
26	c	Stephen mar.	7	42	K
27	d	Iohn Euangel	7	44	L
28	e	Innocents day	7	45	l
29	f	Trā of James	7	46	m
30	g	Siluester.	7	48	n
31	A			50	o

A table wherin is shewed at all times, what signe the Moone shal be in by the Prime & helpe of the letters, in the last Colomne of the Kalender as by example is hereafter shewed.

The Prime	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Aries.	y	n	c	v	i	u	l	q	z	p	e	u	m	a	s	i	ȝ	q	f
Arie.	z	o	d	u	m	a	s	t	ȝ	q	f	r	u	d	t	k	ſt	r	g
Arie.	ȝ	p	e	r	n	d	t	k	ſt	r	g	y	o	c	d	l	a	ſ	h
Taurꝰ.	ſt	q	f	y	o	c	d	l	a	ſ	h	z	p	d	u	m	b	s	i
Taurꝰ.	a	r	q	z	y	d	u	m	b	s	i	ȝ	q	e	r	n	c	t	k
Gemin.	d	ſ	h	ȝ	q	e	r	n	c	t	k	ſt	r	f	y	o	d	d	l
Gemin.	c	s	i	ſt	r	f	y	o	d	d	l	a	ſ	g	z	p	e	u	m
Cancer	d	t	k	a	ſ	g	z	p	e	u	m	b	s	h	ȝ	q	f	r	n
Cancer.	e	d	l	b	s	h	ȝ	q	f	r	n	c	t	i	ſt	r	g	y	o
Leo.	f	u	m	c	t	i	ſt	r	g	y	o	d	d	k	a	ſ	h	z	p
Leo.	g	r	n	d	d	k	a	ſ	h	z	p	e	u	l	d	s	i	ȝ	q
Leo.	h	y	o	e	u	l	b	s	i	ȝ	q	f	r	m	c	t	k	ſt	r
Virgo.	i	z	p	f	r	m	c	t	k	ſt	r	g	y	n	d	d	l	a	ſ
Virgo	k	ȝ	q	g	y	n	d	d	l	a	ſ	h	z	o	e	u	m	b	s
Libra.	l	ſt	r	h	z	o	e	u	m	b	s	i	ȝ	p	f	r	n	c	t
Libra.	m	a	ſ	i	ȝ	p	f	r	n	c	t	k	ſt	q	g	y	o	d	d
Scorpio.	n	b	s	k	ſt	q	g	y	o	d	d	l	a	r	h	z	p	e	u
Scorpio.	o	c	t	l	a	r	h	z	p	e	u	m	b	ſ	i	ȝ	q	f	r
Sagittarius.	p	d	d	m	b	ſ	i	ȝ	q	f	r	n	c	s	k	ſt	r	g	y
Sagittarius.	q	e	u	n	c	s	k	ſt	r	g	y	o	d	t	l	a	ſ	h	z
Sagittarius.	r	f	r	o	d	t	l	a	ſ	h	z	p	e	d	m	b	s	i	ȝ
Capricorne.	ſ	g	y	p	e	d	m	b	s	i	ȝ	q	f	u	n	c	t	k	ſt
Capricorne.	s	h	z	q	f	u	n	c	t	k	ſt	r	g	r	o	d	d	l	a
Aquarius.	t	i	ȝ	r	g	r	o	d	d	l	a	ſ	h	y	p	e	u	m	b
Aquarius.	d	k	ſt	ſ	h	y	p	e	u	m	b	s	t	z	q	f	r	n	c
Pisces.	u	l	a	s	i	z	q	f	r	n	c	t	k	ȝ	r	g	y	o	d
Pisces.	r	m	b	t	k	ȝ	r	g	y	o	d	d	l	ſt	ſ	h	z	p	ȝ
Pisces.	y	n	c	d	l	ſt	ſ	h	z	p	e	u	m	a	s	i	ȝ	q	f

The vſe of the table.

FIrſt goe to the Kelender, to the daie of the monthe which ye deſire to know what ſigne the Moone is in: And in the laſt cullum of that monthe vnder the Moone, in the head thereof, directly againſt the ſame daie, you ſhall finde one of the 24. letters, which you ſhall beare in memorie, and returne to the Prime of the preſent yeere, in the head of this Table, deſcending downe by the cullum of the ſame prime, vntill yee finde the letter yee beare in memorie, of the Kalender, and directly againſt this ſquare, or letter in the firſt cullum yee ſhall finde named the ſigne that the Moone then occupieth.

As for example.

The yere 1581. the 12. of June, I deſire to know what ſigne the Moone is in, I goe to the Kalender to that Moneth of June to the 12. day, againſt which, in the laſt cullum, vnder the Moone, in the head of the moneth I finde the letter a, which bearing in memorie, I returne to thys Table, to the Prime of this yeare, which I ſeeke in the table of the moueable feaſts, and find to be 5. where I enter the Table, in the head, and in the firſt cullum, deſcending downe, vntill I finde (a) againſt which to the left hand, in the firſt cullum, I finde Scorpio, which ſheweth the moone to be in that ſigne.

THE CONTENTES
Of this booke.

The

The eight chapter.

Certaine proofes of the power and action, wholie and freelie being in this Stone, to shewe this point Respectiue and in the Needle, by vertue & power receiued of the stone, and not forced, or constrained by any Attractiue in Heauen or Earth.

The ninth chapter.

Of the Variation of the Needle, from the Pole or Axeltree of the Earth, and how it is to be vnderstood.

The tenth chapter.

Of the common Compasses, and of the diuers different sorts and makings of them, with the inconueniences that may grow by them, and the plats made by them.

A Table or Regiment of the sunnes declination, exactly calculated vnto the minute by the true place of the sunne, whose greatest Declination for this age is 23. Degrees 28. minutes, & may serue for 30. yeeres without great errour.

How to vse the sunnes Declination, for knowing the eleuation of the pole.

Three Tables, the first sheweth the coniunctions of the sunne and Moone for 19. yeares, with the Eclipses of the sunne.

A

The second Table sheweth the houre and minute of the opposition or full Moones, with the Eclipses of the moone.

The third Table followeth the Kalender, by the which

is alwaies found what ſigne the Moone is in, with the help of the letters in the Kalender, alſo by the ſaide kalender is ſhewed the houre and minute of the length of the day, for euerie day of the yere, for the eleuation of the Pole. 52. degrees.

A Table to know what Planet rules anie houre either by day or night.

A Table to know the length of the planetarie hour, frō the ſhorteſt day and longeſt night, till the longeſt day and ſhorteſt night.

A Chapter of the longitude and declination of 32. notable fixed ſtarres very neceſſary for Nauigation, with tables of their ſhining, and at what point of your Compaſſe they doo both riſe and ſet: and alſo Tables for euerie Moneth of the yere, declaring at what houre and minute they be South, running from the firſt day of the month, to the fifteenth, and from the fiftеenth to the laſt day, and wyll continue theſe 100. yeeres without much error.

A Table to knowe the riſing and ſetting of theſe ſtars, by what point of the Compaſſe, & how many houres they be aboue our Horizon, the pole being raiſed 51. or 52 de-

A table of the fixed Starres.
A Table of the true place of the Sunne.
The Table of the Equation of the Sunne.
The Chapter of the declination of the Sunne.

A Table to know what Planet rules anie houre, either of day or night for euer.

Gouerners of the day.	Sundaie.	Mundaie.	Tuesdaie.	Wednesday.	Thurday.	Friday.	Saturdaie.	Rulers of the night.
Sol.	1	12	9	☽	10	☉	11	Iupiter.
Venus.	2	☽	10	☉	11	1	12	Mars.
Mercurie.	3	☽	11	1	12	2	☉	Sol.
Luna.	4	1	12	2	☽	3	☉	Venus.
Saturne.	5	2	☉	3	☽	4	1	Mercurie.
Iupiter.	6	3	☉	4	1	5	2	Luna.
Mars.	7	4	1	5	2	5	3	Saturne.
Sol.	8	5	2	6	3	7	4	Iupiter.
Venus.	9	5	3	7	4	8	5	Mars.
Mercurie.	10	7	4	8	5	☽	6	Sol.
Luna.	11	8	5	9	6	10	7	Venus.
Saturne.	12	9	6	10	7	11	8	Mercurie.
Iupiter.	☉	10	7	11	8	12	9	Luna.
Mars.	☉	11	8	12	9	☽	10	Saturne.

The vse of this Table is thus.

VNder the day of your request, seeke the houre that ye desire, thē on the left side right there against shal ye see the Planet that gouernes that houre by daie, & at the right side, the Planet that rules it by night, as thus. On Thursday the third houre of the daie rules ☉. and the 8. houre of the night gouernes ☽. and so of the rest, for it is plaine enough.

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A Table to know the length of the planetarie houre, from the ſhorteſt day and longeſt night, till the longeſt day & ſhorteſt night.

M.	0	12	24	36	48
H.	H.M.	H.M.	H.M.	H.M.	H.M.
7	0. 35	0. 36	0. 37	0. 38	0. 39
8	0. 40	0. 41	0. 42	0. 43	0. 44
9	0. 45	0. 46	0. 47	0. 48	0. 49
10	0. 50	0. 51	0. 52	0. 53	0. 54
11	0. 55	0. 56	0. 57	0. 58	0. 59
12	1. 0	1. 1	1. 2	1. 3	1. 4
13	1. 50	1. 6	1. 7	1. 8	1. 9
14	1. 29	1. 11	1. 12	1. 13	1. 14
15	1. 25	1. 16	1. 17	1. 18	1. 19
16	1. 20	1. 21	1. 22	1. 23	1. 24
17	1. 20	1. 26	1. 27	1. 28	1. 29

The vſe is this.

Knowe the length of the day or night, that ye require by the Table proceeding in houres & minutes, and therewith enter this Table, the houre at the ſide, and the neereſt minute at the head, and then diſcend right againſt your houre and there in the common angle ſhall ye finde the houre and minute, or minutes onely that the Planet raignes by the houres of the clocks.

As for Example.

The 12. of June the daye is 16. houres, 20. minutes, wherewith I enter this Table as is ſhewed, & in the angle I find 1 houre 22. minutes, which ſheweth that a planet that day rules an houre & a quarter, and 7. min. of the clocks. Alſo for the ſame night I find it to be but 7. houres 40. minuts, wherewith I enter into this table with 7. at the ſide, 36. at the head (for that is neereſt) and in the common angle I finde but onely 38. minutes, which ſheWe that a Planet in that night rules but halfe an houre and 8 minutes of the clockes, and ſo of the reſt.

This Chapter is of the longitude, and the Declination of 32. notable fixed Starres, verie necessarie for Nauigation wyth Tables of their shining, and at what point of your Compasse they do both rise and set: and also tables for euery moneth of the yeare, declaring at what houre and minute they be south, running from the first day of the moneth, to the fifteenth: & from the fifteenth to the last day, and will continue these 100. yeare without much errour.

Doo thinke it conuenient for diuerse considerations, to shewe the longitude and declination of certaine of the most notablest fixed Starres that are neere vnto the Equinoctiall, to the number of 32. of them which are verie necessarie for Naugatyon in diuers respectes, as this: If you bee vnto the North partes, where the North Pole is raised more then 50. or 60. degrées, then the North Starre is too high to be obserued or taken with the crosse Staffe (as Master Boorne hath declared in his first Chapter of his Regiment for the Sea) and it may chance so, that in the day the Sun is not to be seene at noone, and then these starres may serue your turne.

If the pole be raised more thē 50. or 60. degrees it is to high to be obserued by the crosse staffe.

And further more, they be very good for them that haue occasion to trauaile beyond the Equinoctiall, where the North Pole is vnder the Horizon, in vsing their declination as they doe the Sunnes declination in all pointes (as doeth appeare in the 7. 8. and 9. Chapter of M. Boornes Regiment.) And moreouer, they bee very necessarie for Sea-faring men to knowe the houres of the night, both by their being vpon the Meridian, and also by their rising and setting, you may knowe the true time of their rising and

These starres will serue beyond the Equinoctiall.

A Table to know the length of the planetarie houre, from the ſhorteſt day and longeſt night, till the longeſt day & ſhorteſt night.

M	0	12	24	36	48
H	H.M.	H.M.	H.M.	H.M.	H.M.
7	0. 35	0. 36	0. 37	0. 38	0. 39
8	0. 40	0. 41	0. 42	0. 43	0. 44
9	0. 45	0. 46	0. 47	0. 48	0. 49
10	0. 50	0. 51	0. 52	0. 53	0. 54
11	0. 55	0. 56	0. 57	0. 58	0. 59
12	1. 0	1. 1	1. 2	1. 3	1. 4
13	1. 50	1. 6	1. 7	1. 8	1. 9
14	1. 29	1. 11	1. 12	1. 13	1. 14
15	1. 25	1. 16	1. 17	1. 18	1. 19
16	1. 20	1. 21	1. 22	1. 23	1. 24
17	1. 20	1. 26	1. 27	1. 28	1. 29

The vſe is this.

Knowe the length of the day & night, that ye require by the Table proceeding in houres & minutes, and therewith enter this Table, the houre at the ſide, and the neereſt minute at the head, and then diſcend right againſt your houre and there in the common angle ſhall ye finde the houre and minute, or minutes onely that the Planet raignes by the houres of the clocks.

As for Example.

The 12. of June the daye is 16. houres, 20. minutes, wherewith I enter this Table as is ſhewed & in the angle I find 1 houre 22. minutes, which ſheweth that a planet that day rules an houre & a quarter, and 7. min. of the clocks. Alſo for the ſame night I find it to be but 7. houres 40. minuts, wherewith I enter into this table with 7. at the ſide, 36. at the head (for that is neereſt) and in the common angle I finde but onely 38. minutes, which ſheWe that a Planet in that night rules but halfe an houre and 8 minutes of the clockes, and ſo of the reſt.

This Chapter is of the longitude, and the Declination of 32. notable fixed Starres, verie necessarie for Navigation wyth Tables of their shining, and at what point of your Compasse they do both rise and set: and also tables for euery moneth of the yeare, declaring at what houre and minute they be south, running from the first day of the moneth, to the fifteenth: & from the fifteenth to the last day, and will continue these 100. yeare without much errour.

Doe thinke it conuenient for diuerse considerations, to shew the longitude and declination of certaine of the most notablest fixed Starres that are neere vnto the Equinoctiall, to the number of 32. of them which are verie necessarie for Navigation in diuers respectes, as this: If you bee vnto the Northy partes, where the Northy Pole is raised more then 50. or 60. degrées, then the Northy Starre is too high to be obserued or taken with the crosse Staffe (as Master Boorne hath declared in his first Chapter of his Regiment for the Sea) and it may chance so, that in the day the Sun is not to be seene at noone, and then these starres may serue your turne.

If the pole be raised more thē 50. or 60. degrees it is to high to be obserued by the crosse staffe.

And further more, they be very good for them that haue occasion to trauaile beyond the Equinoctiall, where the Northy Pole is vnder the Horizon, in vsing their declination as they doe the Sunnes declination in all pointes (as doeth appeare in the 7. 8. and 9. Chapter of M. Boornes Regiment.) And moreouer, they bee very necessarie for Sea-faring men to knowe the houres of the night, both by their being vpon the Meridian and also by their rising and setting, you may knowe the true time of their rising and

These starres will serue beyond the Equinoctiall.

and setting, you may knowe the true time of their rising and setting in euerie Latitude by their declination from the Equinoctiall, whether they decline to the South parts or North partes, (as is declared by the declination of the Sunne in the 11. Chapter of M. Boornes Regiment.

And furthermore, by any of these Starres you may trie the Variation of your Compasse by night, &c. Nowe shall followe the Table of all these Starres. The first rowe of this Table, containeth the names of the starres: The second the signes, what they be in longitude: The third, the degrees of the signes: The fourth, the minutes belonging thereunto: The fift, the degrees of declination: The sixt, the odde minutes belonging thereunto. The seauenth sheweth towarde what place they decline, by letters, of which S. signifieth the Septentrional, or north declination M. signifieth Meridionall, or south declination, as in the Table doth appeare. The eight doth shewe nothing but the bignesse of the Starres. Now followeth the Table.

The order of the Table following.

A Ta-

The names of the starres.	Signes.	Longit. degree.	Declin. co. min.	N or S	what par	Signes of the starres
Whales backe.	Aries.	6. 6	12.11	M	second bignes.	
Whales bellie.	Aries.	16. 2	12.20	M	second bignes.	
Rams horne.	Aries.	27.42	17.19	S	third bignes.	
Rams head.	Taurus.	1. 46	21.16	S	third bignes.	
Bulles eie.	Gemini	3. 42	14.42	S	great starres.	
Orions left foote.	Gemini	10.12	7. 14	M	great starre.	
Orions left shoulder.	Gemini	11.26	4. 37	S	a starre of the	
First Orions girdle	Gemini	16.22	1. 19	M	second light both.	
Orios right shulders.	Gemini	23. 6	5. 18	S	a great starre.	
Great dogge.	Cancer	8. 40	15.30	M	a very great star	
Lesser dogge.	Cancer.	20.10	5. 4	S	a great star.	
Bright in Hydra.	Leo.	31. 2	4. 47	M	second bignes.	
Lions necke.	Leo.	23.16	21.59	S	second bignes.	
Lions heart.	Leo.	23.32	14. 3	S	a great star.	
Lions backe.	Virgo.	5. 16	22.30	S	second bignes:	
Lions taile.	Virgo	15.32	16.46	S	a great star.	
Rauens head.	Libra.	5. 6	19.53	M	of ye third bignes.	
Rauens wing.	Libra.	9. 38	17. 8	M	both those.	
Virgins spike.	Libra.	17.42	4. 54	M	a great star.	
Twixt boots thighs.	Libra.	18. 6	22. 9	S	a great star,	
South ballance.	Scorpio	9. 2	13.44	M	second bignes.	
North ballance.	Scorpio	13.12	7. 33	M	second bignes.	
Scorpions heart.	Sagit.	3. 42	24.47	M	second bignes.	
Hercules head.	Sagit.	8. 42	15.28	S	third bignes.	
Serpents head.	Sagit.	15.52	14. 7	S	third bignes.	
The Eagle	Capric.	24.51	7. 28	S	second bignes.	
Dolphins taile.	Aquar.	8. 27	10. 1	S	third bignes.	
Goates taile.	Aquar.	17.22	12.13	M	third bignes.	
Water pourers leg	Pisces.	2. 28	17.52	M	third bignes.	
Pegasus shoulder.	Pisces.	17. 4	13. 1	S	second bignes.	
Pegasus legge.	Pisces.	23.10	26.30	S	second bignes.	
Whales tayle.	Pisces.	26.21	21.47	M	third bignes.	

The

N.B. the letters m. and s. in the fourth Column signifie north and south declination as m. meridionall or south and s. septentrionall or North

The vse of this Table is this: when you haue taken the height of any of these starres vpon the Meridian, then looke what declination the starre hath from the Equinoctiall: If the starre hath North declination, then subtract or take awaye the starres declination from the height: If it hath south declination, then adde or put vnto the height, the starres declination, and that will shewe vnto you the height of the Equinoctiall, and then by the height of the Equinoctiall, the height of the pole is knowen, as Master Boorne hath declared in the 7. Chapter of the Regiment for the sea. And now I thinke it conuenient to make a certaine Table, to shewe vnto you at what houre and time any of these starres bee vpon the Meridian, whereby they may the better knowe these starres. I will also shewe vnto you howe long any of these starres doe shine or tarrie aboue the Horizon in this Latitude from the Equinoctiall of London, that is at 51. or 52. degrees. And also at what point of the compasse any of these starres doe rise or set, which will serue this 100. yeares without much errour.

How to vse the starres declination to know the height of the Pole.

A Table to know the rising and setting of these starres by what point of the compasse, & howe many houres they be aboue our Horizon, the pole being raised 51. or 52. degrees.

The Whales backe riseth East and by south, and vnto the southwardes: and shineth 10. houres & better.

The Whales belly (in a manner) as the Whales backe.

The Rams horne riseth East Northeast, and setteth West Northwest, and shineth 15. houres 16. minutes.

The Rammes head riseth East Northeast, and setteth West Northwest and shineth 16. houres 4. minutes.

The Bulls eye riseth neere the East Northeast, and setteth neere the West Northwest, and shineth 15. houres 2. minutes.

The Orions left foote riseth neer ye East and by south and setteth neere the West and by south, and shineth 10.

houres

houres and 6.minutes.

The Orions left shoulder riseth East and to the northwards, and setteth West and to the Northwards, and shineth 11.houres 45.minutes.

The first in Orions girdle dooth rise a little to the Southwards of the East, and setteth a little to the southwards of the West, and shineth 11. houres 46.minutes.

Orions right shoulder riseth East, and vnto the Northwards, and setteth West and vnto the Northwards: and shineth 13 houres 12.minutes.

The great dog riseth East southeast, and setteth west southwest, and shineth 9. houres.

The lesser dog riseth East and vnto the Northwardes, and setteth West and vnto Northwardes, and shineth 13. houres 10. minutes.

The brightest in Hydra riseth East and vnto the southwards, and setteth West and vnto southwardes, and shyneth 11.houres and 7.minutes.

The Lyons necke riseth East Northeast, and to the Northwards, & setteth west Northwest, and to the Northwards, and shineth 16.houres 16.minutes.

The Lyons hart riseth neere the East Northeast, and setteth neere the West Northwest, and shineth 14.houres 50.minutes.

The Lyons backe riseth neere the Northeast and by East, and setteth neere the Northwest and by weast, and shineth 16.houres 26.minutes.

The Lyons taile riseth neere the East Northeast, and setteth neere the West Northwest, and shineth 15.houres 12.minutes.

The Rauens head riseth neere the East southeast, and setteth neere the West southwest, and shineth 8. houres 12.minutes.

The Rauens wing riseth neere the East southeast, and setteth neere the west southwest, and shineth 8. houres 50.minutes.

The

The virgins spike riseth East and to the southwards, and setteth West and to the southwards, and shineth 11. houres 4. minutes.

Betwéen boots thighs, riseth néere the Northeast and by East, and setteth neere the Northwest, and by West, and shineth 16. houres 20. minutes.

The South ballance riseth neere the East southeast, and setteth neere the West southwest: and shineth 9. houres 36. minutes.

The Northballance riseth neere the East and by south and setteth neere the West and by south, and shineth 10 houres 38. minutes.

The Scorpions heart riseth neere the southeast and by east, and setteth neere the southwest and by West, and shineth 7. houres. 5. minutes.

Hercules head riseth neere the East Northeast, and setteth néere the West Northwest, and shineth 14. houres. 56 minutes.

The Serpents head riseth néere the East Northeast, and setteth neere the West Northwest, , and shineth 14. houres 40. minutes.

The Eagle riseth neere by East and by North, and setteth neere the West and by North, and shineth 13. houres 24. minutes.

The Dolphins taile riseth East and by North, and setteth West and by North, and shineth 15. houres 57. minutes.

The 11 Chapter of M. Boornes Regiment for the Sea, will shewe howe long any of these starres will shine in all places.

The Goates taile riseth neere the East southeast, and setteth West southwest, and shineth 9. houres 20. minutes.

The Water powzers leg riseth neere the East southeast, and setteth West southwest, and shineth 8. houres, 54. minutes.

Pegasus shoulders riseth neere the East Northeast, and setteth neere the West Northwest, and shineth 14. houres 32. minutes.

Pegasus

Pegasus legge riseth neere Northeast, and setteth neere Northwest, and shineth 17. houres 6 minutes.

The Whales taile riseth East Southeast, and setteth West Southwest, and shineth 7. houres 48. minutes.

Furthermore, if you desire to knowe the time of any of these starres beeing aboue the Horizon in all Latitudes, then repaire to the eleuenth Chapter of Maister Boornes Regement for the sea, & you shall knowe it there by their declination: euen by the same order that you knowe the Sunnes beeing aboue the Horizon, by the Sunnes declination.

Vid. 11. Chap in the regiment for the Sea

	These Stares being South from the first day of Ianu. vnto the 15			Ianu. from the 15 to the last			Febru. vnto the 15			Febru. frō the 15. to the last		
1	Whales backe.	5.	20	E	1	4.20	DA	1	3.20	DA	1	2.20	DA
2	Whales bellie.	5.	54	E	2	4.54	DA	2	3.54	DA	2	2.54	DA
3	Rammes horne.	6.	28	E	3	5.28	E	3	4.28	DA	3	3.28	DA
4	Rammes head.	6.	45	E	4	5.45	E	4	4.44	DA	4	3.45	DA
5	Buls eie.	8.	52	E	5	7.52	E	5	[illegible]2	E	5	5.52	DA
6	Orions left foote.	9.	23	E	6	8.23	E	6	7.23	E	6	6.23	E
7	Orions left shulder.	9.	28	E	7	8.28	E	7	7.28	E	7	6.28	E
8	First Orions girdle.	9.	50	E	8	8.50	E	8	7.50	E	8	6.50	E
9	Orions right shulder	10.	12	E	9	9.12	E	9	8.12	E	9	7.12	E
10	Great dogge.	11.	4	E	10	10.4	E	10	9. 4	E	10	8. 4	E
11	Lesser dogge.	12.	0		11	11.0	E	11	10.0	E	11	9. 0	E
12	Brightest in hydry.	12.	4	M	12	11.4	E	12	10.4	E	12	9. 4	E
13	Lions necke.	2.	12	M	13	1.12	M	13	12.12	M	13	11.12	E
14	Lions heart.	2.	13	M	14	1.13	M	14	12.13	M	14	11.13	E
15	Lions backe.	3.	0	M	15	2. 0	M	15	1. 0	M	15	12.0	
16	Lions tayle.	3.	42	M	16	2.42	M	16	1.42	M	16	1.42	M
17	Rauenss head.	4.	2	M	17	3. 2	M	17	3. 2	M	17	2. 2	M
18	Rauens wing.	4.	19	M	18	4.19	M	18	3.19	M	18	2.19	M
19	Virgins spike.	5.	51	M	19	4.51	M	19	3.51	M	19	2.51	M
20	Twixt both thighs.	5.	56	M	20	4.56	M	20	3.56	M	20	2.56	M
21	South Balance.	7.	16	M	21	6.16	M	21	5.16	M	21	4.56	M
22	North Balance.	7.	33	MD	22	6.33	M	22	5.53	M	22	4.33	M
23	Scorpions heart.	8.	54	MD	23	7.54	MD	23	6.54	M	23	5.54	M
24	Hercules head.	9.	14	MD	24	8.14	MD	24	7.14	MD	24	6.14	M
25	Serpentes head.	9.	41	MD	25	8.41	MD	25	7.41	MD	25	6.41	M
26	The Eagle.	12.	19	DA	26	11.19	MD	26	10.19	MD	26	9.19	MD
27	Dolphins tayle.	1.	12	DA	27	12.12	DA	27	11.12	MD	27	10.12	MD
28	Goates tayle.	1.	48	DA	28	12.48	DA	28	11.48	MD	28	10.48	MD
29	Water pourers leg.	2.	48	DA	29	1.48	DA	29	12.48	DA	29	11.48	MD
30	Pegalus shoulder.	3.	47	DA	30	2.47	DA	30	1.47	DA	30	12.47	DA
31	Pegalus leg.	4.	12	DA	31	3.12	DA	31	2.12	DA	31	1.12	DA
32	Whales tayle.	4.	24	DA	32	3.24	DA	32	2.24	DA	32	1.24	DA

March fro the irst to the 15.			March frō the 15. to the last.			April from the first to the 15.			April from the 15 ro the last.			May from the first to the 15	
1	1. 20	DA	1	11.20	DA	1	11.20	MD	1	10.20	MD	1	9.20 MD
2	1. 54	DA	2	12.54	DA	2	11.54	MD	2	10.54	MD	2	9.54 MD
3	2. 28	DA	3	1.28	DA	3	12.28	DA	3	11.28	MD	3	10.28 MD
4	2. 45	DA	4	1.45	DA	4	12.45	DA	4	11.45	MD	4	10.45 MD
5	4. 52	DA	5	3.52	DA	5	2.52	DA	5	1,52	DA	5	12.52 DA
6	5. 23	DA	6	4.23	DA	6	3.23	DA	6	2,23	DA	6	1.23 DA
7	5. 28	DA	7	4.28	DA	7	3.28	DA	7	2.28	DA	7	1.28 DA
8	5. 50	DA	8	4.50	DA	8	3.50	DA	8	2.50	DA	8	1.50 DA
9	6. 12	E	9	5.12	DA	9	4.12	DA	9	3.12	DA	9	2.12 DA
10	7. 4	E	10	6. 4	DA	10	5. 4	DA	10	4. 4	DA	10	3. 4 DA
11	8. 0	E	11	7. 0	E	11	6. 0	DA	11	5. 0	DA	11	4. 0 DA
12	8. 4	E	12	7. 4	E	12	6. 4	DA	12	5. 4	DA	12	4. 4 DA
13	10.12	E	13	9.12	E	13	8.12	E	13	7.12	DA	13	6.12 DA
14	10.13	E	14	9.13	E	14	8.13	E	14	7.13	DA	14	6.13 DA
15	11. 0	E	15	10. 0	E	15	9. 0	E	15	8. 0	E	15	7. 0 DA
16	11.42	E	16	10.42	E	16	9.42	E	16	8.42	E	16	7.42 DA
17	1. 2	M	17	12. 2	M	17	11.2	E	17	10.2	E	17	9. 2 E
18	1. 19	M	18	12.19	M	18	11.19	E	18	10.19	E	18	9.19 E
19	1. 51	M	19	12.51	M	19	11.51	E	19	10.51	E	19	9.51 E
20	1. 56	M	20	12.56	M	20	11.56	E	20	10.56	E	20	9.56 E
21	3. 16	M	21	2.16	M	21	1.16	M	21	12.16	M	21	11.16 E
22	3. 33	M	22	2.33	M	22	1.33	M	22	12.33	M	22	11.33 E
23	4. 54	M	23	3.54	M	23	2.54	M	23	1.54	M	23	12.54 M
24	5. 14	M	24	4.14	M	24	3.14	M	24	2.14	M	24	1.14 M
25	5. 41	M	25	4.41	M	25	3.41	M	25	1.41	M	25	3.41 M
26	8. 19	DM	26	7.19	MD	26	6.19	MD	26	5.19	MD	26	4.19 M
27	9. 12	DM	27	8.12	MD	27	7.12	MD	27	9.12	MD	27	5.12 MD
28	9. 48	DM	28	8.48	MD	28	7.48	MD	28	7.48	MD	28	5.48 MD
29	10.48	DM	29	9.48	MD	29	8.48	MD	29	7.48	MD	19	6.48 MD
30	11.47	DM	30	10.47	MD	30	9.47	MD	30	8.47	MD	30	7.47 MD
31	12.12	DA	31	11.12	MD	31	10.12	MD	31	9.12	MD	31	8.12 MD
32	12.24	DA	32	11.24	MD	32	10.24	MD	32	9.24	MD	32	3.24 MD

May from the 15. to the last.			June from the first to the 15.			June from the 15 to the last			July from the first to the 15.			July from the 15 to the last.		
1	8.20	MD	1	7.20	MD	1	6.20	MD	1	5.20	MD	1	4.20	M
2	8.54	MD	2	7.54	MD	2	7.54	MD	2	5.54	MD	2	4.54	MD
3	9.28	MD	3	8.28	MD	3	7.28	MD	3	6.28	MD	3	5.28	MD
4	9.45	MD	4	8.45	MD	4	7.45	MD	4	6.45	MD	4	5.45	MD
5	11.52	MD	5	10.52	MD	5	9.52	MD	5	8.52	MD	5	7.52	MD
6	12.23	DA	6	11.23	MD	6	10.23	MD	6	9.23	MD	6	8.23	MD
7	12.28	DA	7	11.28	MD	7	10.28	MD	7	9.28	MD	7	8.28	MD
8	12.50	DA	8	11.50	MD	8	10.50	MD	8	9.50	MD	8	8.50	MD
9	1.12	DA	9	12.12	DA	9	11.12	MD	9	10.12	MD	9	9.12	MD
10	2. 4	DA	10	1. 4	DA	10	12.4	DA	10	11.4	MD	10	10.4	MD
11	3. 0	DA	11	2. 0	DA	11	1. 0	DA	11	12.0		11	11.0	MD
12	3. 4	DA	12	2. 4	DA	12	1. 4	DA	12	12.4	DA	12	11.4	MD
13	5.12	DA	13	4.12	DA	13	3 12	DA	13	2.12	DA	13	1.12	DA
14	5.13	DA	14	4.13	DA	14	3.13	DA	14	2.13	DA	14	1.13	DA
15	6. 0	DA	15	5. 0	DA	15	4. 0	DA	15	3. 0	DA	15	2. 0	DA
16	6.42	DA	16	5.42	DA	16	4.42	DA	16	3.42	DA	16	2.42	DA
17	8. 2	DA	17	7. 2	DA	17	6.2	DA	17	5. 2	DA	17	4. 2	DA
18	8.19	DA	18	7.19	DA	18	6.19	DA	18	5.19	DA	18	4.19	DA
19	8.51	DA	19	7.51	DA	19	6.51	DA	19	5.51	DA	19	4.51	DA
20	8.56	DA	20	7.56	DA	20	6.56	DA	20	5.56	DA	20	4.56	DA
21	10.16	E	21	9.16	DA	21	8.16	DA	21	7.16	DA	21	6.16	DA
22	10.33	E	22	9.33	DA	22	8.33	DA	22	7.33	DA	22	6.33	DA
23	11.54	E	23	10.54	E	23	9.54	DA	23	8.54	DA	23	7.54	DA
24	12.14	M	24	11.14	E	24	10.14	E	24	9.14	E	24	8.14	E
25	12.41	M	25	21.41	E	25	10.41	E	25	9.41	E	25	8.41	E
26	3.19	M	26	2.19	M	26	1.19	E	26	12.19	M	26	11.19	E
27	4.12	MD	27	3.12	M	27	2.12	M	27	1.12	M	27	12.12	E
28	4.48	MD	28	3.48	M	28	2.48	M	28	2.48	M	28	12.48	M
29	5.48	MD	29	4.48	MD	29	3.48	M	29	2.48	M	19	1 48	M
30	6.47	MD	30	5.47	MD	30	4. 7	MD	30	3.47	M	30	2.47	M
31	7.12	MD	31	6.12	MD	31	5.12	MD	31	4.12	MD	31	3.12	M
32	7.24	MD	32	6.24	MD	32	5.24	MD	32	2.24	MD	32	3.24	M

Auguſt tro the firſt to the 15			Augu. tro the 15. to the laſt			Septem. tro the firſt to the 15.			Septē. tro the 15. to the laſt			Octō tro the firſt to the 15		
1	3.20	M	1	2.20	M	1	1.20	M	1	12.20	M	1	11.20	E
2	3.54	M	2	2.54	M	2	1.54	M	2	12.54	M	2	11.54	E
3	4.28	M	3	3.28	M	3	2.28	M	3	1.28	M	3	12.28	M
4	3.45	MD	4	3.45	M	4	2.45	M	4	1.45	M	4	12.45	M
5	6.52	MD	5	5.52	MD	5	4.52	M	5	3.52	M	5	2.52	M
6	7.23	MD	6	6.23	MD	6	5.23	M	6	4.23	M	6	3.23	M
7	7.28	MD	7	6.28	MD	7	5.28	M	7	4.28	M	7	3.28	M
8	7.50	MD	8	6.50	MD	8	5.50	MD	8	4.50	M	8	3.50	M
9	8.12	MD	9	7.12	MD	9	6.12	MD	9	5.12	M	9	4.12	M
10	9. 4	MD	10	8.-4	MD	10	7. 4	MD	10	6. 4	MD	10	5. 4	M
11	10.0	MD	11	9. 0	MD	11	8. 0	MD	11	7. 0	MD	11	6. 0	M
12	10.4	MD	12	9. 4	MD	12	8. 4	MD	12	7. 4	MD	12	6. 4	M
13	12.12	DA	13	11.12	MD	13	10.12	MD	13	9.12	MD	13	8.12	MD
14	12.13	DA	14	11.13	MD	14	10.13	MD	14	9.13	MD	14	8.13	MD
15	1. 0	DA	15	12. 0		15	11. 0	MD	15	10.0	MD	15	9. 0	MD
16	1.42	DA	16	12.42	DA	16	11.42	MD	16	10.42	MD	16	9.42	MD
17	3. 2	DA	17	2. 2	DA	17	1. 2	DA	17	12.2	DA	17	11.2	MD
18	3.19	DA	18	2.19	DA	18	1.19	DA	18	12.19	DA	18	11.19	MD
19	3.51	DA	19	2.51	DA	19	1.51	DA	19	12.51	DA	19	11.51	MD
20	3.56	DA	20	2.56	DA	20	1.56	DA	20	12.56	DA	20	11.56	MD
21	5.16	DA	21	4.16	DA	21	3.16	DA	21	2.16	DA	21	1.16	DA
22	5.33	DA	22	4.33	DA	22	3.33	DA	22	2.33	DA	22	1.33	DA
23	6.54	DA	23	5.54	DA	23	4.54	DA	23	3.54	DA	23	2.54	DA
24	7.14	DA	24	6.14	DA	24	5.14	DA	24	4.14	DA	24	3.14	DA
25	7.41	DA	25	6.41	DA	25	5.41	DA	25	4.41	DA	25	3.41	DA
26	10.19	E	26	9.19	E	26	8.19	E	26	7.19	E	26	6.19	E
27	11.12	E	27	10.12	E	27	9.12	E	27	8.12	E	27	7.12	E
28	11.48	E	28	10.48	E	28	9.48	E	28	8.48	E	28	7.48	E
29	12.48	M	29	11.48	E	29	10.48	E	29	9.48	E	29	8.48	E
30	1.47	M	30	12.47	E	30	11.47	M	30	10.47	E	30	9.47	E
31	2.12	M	31	1.12	M	31	12.12	M	31	11.12	E	31	10.12	E
32	2.24	M	32	1.24	M	32	12.24	M	32	11.24	E	32	10.24	E

Octo. tro the 15 to the last			Nouem. tro the first to the 15			Noue, tro the 15 to the last			Decem. tro the first tro the 15.			Dece, t o the 15. to the last		
1	10.20	E	1	9.20	E	1	8.20	E	1	7.20	E	1	6.20	E
2	14.54	E	2	9.54	E	2	8.54	E	2	7.54	E	2	6.54	E
3	11.28	E	3	10.28	E	3	9.28	E	3	8.28	E	3	7.28	E
4	11.45	E	4	10.45	E	4	9.45	E	4	8.45	E	4	7.45	E
5	1. 52	M	5	12.52	M	5	11.52	E	5	10.52	E	5	9.52	E
6	2. 23	M	6	1.23	M	5	12.23	M	6	11.23	E	6	10.23	E
7	2. 28	M	7	1.28	M	7	12.28	M	7	11.28	E	7	10.28	E
8	2. 50	M	8	1.50	M	8	12.50	M	8	11.50	E	8	10.50	E
9	3. 12	M	9	2.12	M	9	1.12	M	9	12.12	M	9	11.12	E
10	4. 4	M	10	3. 4	M	10	2. 4	M	10	1. 4	M	10	12.4	M
11	5. 0	M	11	4. 0	M	11	3. 0	M	11	2. 0	M	11	1. 0	M
12	5. 4	M	12	4. 4	M	12	3. 4	M	12	2. 4	M	12	1. 4	M
13	7. 12	MD	13	6.12	M	13	5.12	M	13	4.12	M	13	2.12	M
14	7. 13	MD	14	6.13	M	14	5.13	M	14	4.13	M	14	2.13	M
15	8. 0	MD	15	7. 0	M	15	6. 0	M	15	4. 0	M	15	4. 0	M
16	8. 42	MD	16	7.42	MD	16	6.42	M	16	5.42	M	16	4.42	M
17	10. 2	MD	17	9. 2	MD	17	8. 2	MD	17	7. 2	M	17	6. 2	M
18	10.19	MD	18	9.19	MD	18	8.19	MD	18	7. 19	M	18	6.19	M
19	10.51	MD	19	9.51	MD	19	8.51	MD	19	7.51	MD	19	6.51	M
20	10.56	MD	20	9.56	MD	20	8.56	MD	20	7.56	MD	20	6.56	M
21	12.16	DA	21	11.16	MD	21	10 19	MD	21	9.16	MD	21	8.16	MD
22	12.33	DA	22	11.33	MD	22	10.33	MD	22	9.33	MD	22	8.33	MD
23	1. 54	DA	23	12.54	DA	23	11.54	MD	23	10 54	MD	23	6.54	MD
24	2. 14	DA	24	1.14	DA	24	12.14	DA	24	11.14	MD	24	10.14	MD
25	2. 41	DA	25	1.41	DA	25	12.41	DA	25	11.41	MD	25	10.41	MD
26	5. 19	DA	26	4.19	DA	26	3.19	DA	26	2.19	DA	26	10.19	DA
27	6. 12	E	27	5.12	E	27	4.12	E	27	3.12	DA	27	2.12	DA
28	6. 48	E	28	5.48	E	28	4.48	E	28	3.48	DA	28	2.48	DA
29	7. 48	E	29	6.48	E	29	5.48	E	29	4.48	E	29	3.48	DA
30	8. 47	E	30	7.47	E	30	6.47	E	30	5 47	E	30	4.47	E
31	9. 12	E	31	8.12	E	31	7.12	E	31	6.12	E	31	5.12	E
32	9. 24	E	32	8.24	E	32	7.24	M	32	6.24	E	32	5.24	E

Now

Now this Table serueth for euery moneth in the yeare (being exactly calculated) their time of their being South, or touching your Meridian, (or as some tearme it) Noonstead, seruing very well the Seamen to take the height of them, with their Instruments vpon the sea, referring it vnto the Table of declination that goeth before: The first is the houres, the second the minutes, the third be the letters that shew you whether they be south by day or by night, in the euening or morning, in the forenoone or afternoone, of the which the letter E. doth signifie euening, ẏ letter M. signifieth morning, the letters DM. signifieth day in the morning, & the letter DA. signifieth day in the afternoone (as I said before) the very hour and minute being South. Now you see that I haue put to their being south in the day, as well as in the night, to the intent to know the houre of the night, aswel by their setting, as also by our compasse, by bringing your 32. points into 24. houres: And in like maner (as M. Boorne hath shewed in ẏ 4. chapter of his Regiment for the Sea) by shining of ẏ Mon to deuide the shining into equal parts, then those parts being equally deuided with the houre and minutes, & the time before their being south put together ẏ halfe that shine the that, sheweth the iust rising of the Starre, & the other time of their shining after the height being south, sheweth their setting: Now you, seeing the table runneth frō the first side of euery month, to the 15. from the 15. to the last day, must consider (if you will know ẏ exact time betweene the 1. day and the 15. daie, and betwixt the 15. day, and the last) to do this, looke how many daies of the month is past, either from the first daye or fifteenth day, and pul foure minutes from that number: for so manie daies as is past, for euery day that shall shewe you the true time of their being South, that known, you shall do (as is aforesaid) for their rising and setting.

A Table of the true place of the Sunne.

Monthes	Ianu		Februa		March.		April.		Maie.		Iune.	
Signs	Capric.		Aquarius		Pisces.		Aries.		Taurus.		Gemini.	
Daies	G	M	G	M	G	M	G	M	G	M	G	M
1	20	22	21	53	20	55	21	24	20	21	19	55
2	21	24	22	54	21	55	22	22	21	18	20	52
3	22	25	23	54	22	54	23	21	22	16	21	49
4	23	26	24	55	23	54	24	19	23	11	22	46
5	24	27	25	55	24	53	25	17	24	13	23	43
6	25	28	26	56	25	53	26	16	25	8	24	40
7	26	30	27	56	26	52	27	14	26	5	25	37
8	27	31	28	56	27	52	28	12	27	3	26	34
9	28	32	29	57	28	51	29	10	38	0	27	31
10	29	33	☉♓	57	29	50	☉♈	8	28	58	28	28
11	☉♒	35	1	57	☉♈	49	1	5	29	55	29	25
12	1	36	2	58	1	48	2	1	☉♊	52	☉♋	22
13	2	37	3	58	2	47	3	2	1	50	1	19
14	3	38	4	58	3	46	4	0	2	47	2	16
15	4	39	5	58	4	45	5	58	3	44	3	13
16	5	40	6	58	5	44	6	56	4	41	4	10
17	6	41	7	58	6	43	7	54	5	38	5	7
18	7	42	8	58	7	42	8	52	6	36	6	4
19	8	43	9	58	8	41	9	49	7	33	7	1
20	9	44	10	58	9	39	10	47	8	30	8	58
21	10	55	11	58	10	38	11	45	9	27	9	55
22	11	46	12	58	11	37	12	43	10	24	10	52
23	12	47	13	57	12	36	13	40	11	21	11	49
24	13	48	14	57	13	34	14	38	13	18	12	46
25	14	48	15	57	14	33	15	36	14	15	13	43
26	15	49	16	56	15	32	16	33	15	12	14	40
27	16	50	17	56	16	30	17	31	16	10	15	37
28	17	51	18	56	17	29	18	28	17	7	16	34
29	18	51	19	56	18	28	19	26	18	4	17	31
30	19	52			19	27		23	18	1		29
31	20	52			20	25			17	58		

A Table of the true place of Sunne.

Months	Iulie.		August.		Septēber		Octob.		Nouem.		Decem.	
Signes	Cancer		Leo.		Virgo.		Libra.		Scorpio.		Sagitta	
Daie	G	M	G	M	G	M	G	M	G	M	G	M
1	18	26	18	2	18	4	17	39	18	49	19	24
2	19	23	19	0	19	2	18	39	19	50	20	26
3	20	20	19	58	20	1	19	38	20	51	21	27
4	21	17	20	55	21	0	20	38	21	52	22	29
5	22	14	21	53	21	58	21	38	22	53	23	30
6	23	11	22	51	22	57	22	38	23	54	24	31
7	24	8	23	48	23	56	23	38	24	55	25	33
8	25	5	24	46	24	55	24	38	25	56	26	34
9	26	2	25	44	25	54	25	39	26	57	27	36
10	27	0	26	42	26	53	26	39	27	58	28	37
11	7	57	27	40	27	52	27	39	28	59	29	39
12	28	54	28	38	28	51	28	39	☉♑	0	☉♒	40
13	29	51	29	36	29	50	29	39	1	1	1	42
14	☉♌	48	☉♍	34	☉♎	49	☉♏	39	2	3	2	43
15	1	46	1	32	1	48	1	40	3	4	3	45
16	2	43	2	30	2	47	2	40	4	5	4	46
17	3	40	2	28	3	46	3	40	5	6	5	48
18	4	38	4	26	4	45	4	41	6	8	6	49
19	5	35	5	24	5	44	5	41	7	9	7	51
20	6	32	6	22	6	44	5	42	8	10	8	52
21	7	30	7	21	7	43	7	42	9	11	9	54
22	8	27	8	19	8	42	8	43	10	12	10	55
23	9	25	9	17	9	42	9	43	11	13	11	57
24	10	22	10	16	10	41	10	44	12	14	12	58
25	11	20	11	14	11	41	11	45	13	15	13	59
26	12	17	12	13	12	41	12	45	14	16	15	1
27	13	15	13	11	13	40	13	46	15	18	16	2
28	14	12	14	10	14	40	14	47	16	19	17	3
29	15	10	15	8	15	39	15	47	17	20	18	5
30	16	7	16	7	16		16	48	18	22	19	6
31	17	5	17	5			17	49		23	20	7

The yeres of our Lord.	The equation to be added.		of, &c,	the equation, &c.		the yeres of, &c.	the equation, &c.		the yeres of, &c.	the equation, &c.	
	G	M		G	M		G	M		G	M
1545	M	0	1581	1	16	1617	1	32	1653	1	48
1546		45	1582	1	1	1618	1	17	1654	1	33
1547		30	1583		46	1619	1	2	1655	1	18
1548		15	1584		32	1620		47	1656	1	3
1549	1	2	1585	1	18	1621	1	33	1657	1	49
1550		47	1586	1	3	1622	1	18	1658	1	34
1551		32	1587		48	1623	1	3	1659	1	19
1552		18	1588		33	1624		49	1660	1	4
1553	1	4	1589	1	19	1625	1	35	1661	1	51
1554		49	1590	1	4	1626	1	20	1662	1	36
1555		34	1591		49	1627	1	25	1663	1	21
1556		19	1592		35	1628		51	1664	1	7
1557	1	5	1593	1	21	1629	1	37	1665	1	53
1558		50	1594	1	6	1630	1	22	1666	1	38
1559		35	1595		51	1631	1	7	1667	1	23
1560		21	1596		37	1632		53	1668	1	9
1561	1	7	1597	1	23	1633	1	38	1669	1	55
1562		52	1598	1	8	1634	1	23	1670	1	40
1563		37	1599		53	1635	1	8	1671	1	25
1564		23	1600		39	1636		54	1672	1	10
1565	1	9	1601	1	25	1637	1	40	1673	1	56
1566		54	1602	1	10	1638	1	5	1674	1	41
1567		39	1603		55	1639	1	10	1675	1	26
1568		25	1604		40	1640		56	1676	1	12
1569	1	11	1605	1	26	1641	1	42	1677	1	58
1570		56	1606	1	11	1642	1	27	1678	1	33
1571		41	1607		56	1643	1	12	1679	1	28
1572		26	1608		32	1644		8	1680	1	13
1573	1	12	1609	1	28	1645	1	44	1681	R2	⊙
1574		57	1610	1	13	1646	1	29	1682	1	45
1575		42	1611		58	1647	1	14	1683	1	30
1576		28	1612		44	1648	1	0	1684	1	15
1577	1	14	1613	1	30	1649	1	46	1685	1	2
1578		59	1614	1	15	1650	1	31	1686	1	4
1579		44	1615	1	10	1651	1	16	1681	1	32
1580		29	1616		46	1652	1	2	1688	1	8

This Table of the Equation of the Sunne, serueth from the yeare 1545. where it hath his rote or beginning, vntil 1680. and in the yeare of 1681. it shall returne to the roote, adding thereunto one degrée more. As for example: In the yere of 1681. adde one degrée vpon the other degree that the roote hath, and so shal the yere of 1681. haue two degrées of equation, and the yeare of 1682. shall haue one degrée and 45'. Minutes, which is to adde one degrée vpon 45. minutes. that had the yeare 1546. &c. And hauing passed ouer 136. yeares, you shall returne to the roote, adding 2. degrees.

The

This Table of the Equation of the Sunne, serueth from the yeare 1545. where it hath his rote or beginning, vntill 1580. and in the yeare of 1581. it shall returne to the first, adding thereunto one degree more. So as [illegible] yeare of 1581. at the one degree vpon the other degree, [illegible] the rote hath, and so that the yere of 1581. [illegible] equation, and the yeare of 1582. shall haue one degree and 45. Minutes, which [illegible] one degree vpon 45. Minutes that had the yeare 1546. [illegible]
1596. [illegible] shall returne to the rote, adding 2. degrees.

The

Signes.	♈		♎		♑		♋		Signes.
	G	G	M	G	M	G	M	G	
0	0	0		11	30	20	12	30	0
1	0	24		11	51	20	25	29	1
2	0	48		12	12	20	37	28	2
3	1	12		12	33	20	49	27	3
4	1	46		12	53	21	0	26	4
5	2	0		13	13	21	11	25	5
6	2	23		13	33	21	22	24	6
7	2	47		13	53	21	32	23	7
8	3	11		14	13	21	42	22	8
9	3	35		14	32	21	51	21	9
10	3	58		14	52	22	0	20	10
11	4	22		15	12	22	9	19	11
12	4	45		15	31	22	17	18	12
13	5	9		15	51	22	25	17	13
14	5	32		16	10	22	32	16	14
15	5	55		16	29	22	39	15	15
16	6	18		16	48	22	46	14	16
17	6	41		17	7	22	52	13	17
18	7	4		17	26	22	57	12	18
19	7	28		17	45	23	3	11	19
20	7	50		17	4	23	8	10	20
21	8	13		18	23	23	12	9	21
22	8	36		18	41	23	15	8	22
23	8	58		18	59	23	19	7	23
24	9	21		19	18	23	22	6	24
25	9	43		19	36	23	24	5	25
26	10	4		19	54	23	26	4	26
27	10	26		20	12	23	28	3	27
28	10	47		19	46	23	29	2	28
29	11	9		19	59	23	30	1	29
30	11	30		20	12	23	30	0	30
Signes.	♓	♍		♒	♌	♑	♋		Signes.

THe Declination of the Sunne, is the arke of the greater circle, which passeth by the poles of the world, included betweene the Equinoctiall and the Zodiack. And heere is to bee noted, that whatsoeuer foure pointes or prickes which are equallie distant from the point of the Equinoctis (which are the beginning of Aries and Libra) shall haue equall Declinations.

Whereof it followeth, that the foure quarters of the Zodiacke haue equall declinations. And to auoide prolixity I haue added hereunto a table of the declinations of onely one quarter of the Zodiack, so that all hauing one selfe same maner of Declinations, it may serue for all, & the order of it is this. The signes whose Declination increaseth are in the head or front of the table, and ỳ degrees of these signes descend by the left side therof, & the signes whose declination decreaseth, are in ỳ foot of the table: and the degrees of these signes, rise by the right side of the same. The disposition of the table being vnderstood, then to knowe what declination the sunne hath in euerie degree of ỳ Zodiack, you ought to know the true place of the sunne, for the day of the declinatiõ which you desire to know, and the signe which the sun shall bee founde in that day, that you seeke in ỳ front or foot of the table. And if it be in the front, you shall seeke the number of the degrees on ỳ left side, and if it shalbee at the foot of the table, you shal seeke it on the right side. Then aboue or vnder the signe in the front of ỳ degree of the said signe, you shall find two numbers, whereof ỳ first is of degrees, & the second of minutes: and those degrees and minutes of declination, the Sunne hath that day. And this is vnderstood without hauing respect to ỳ

odde minuts aboue the degrée, which the true place of the Sunne hath.

And if you desire to verifie this more precisely, note the Declination of that degrée, and of the degrée following: and take the lesse from the more, and that which remayneth, shalbe the difference of the declination from the one degrée to the other: of which difference ye shal take a part proportionallie, as are the minutes of the place of the sun vnto 60. And this part of minutes muste bee added to the first declination of it, and be lesse then the second, or must be taken from it, if it shall be greater, and then that riseth thereof shall be the precise declination for that signe, degrée, and minute. As for example: In the yeare 1546. the tenth day of September, the Sun shall be in 26. G. 38. M. of Virgo, & the 25. G precise, shal correspond. 1. G. 36. M. of declination. And to verifie the declination that commeth to 38 minuts, which is more of the 26. G. you must marke the difference that is from the declination of 26. G (which is one G. 36. M.) to the declination of the 27. G. which is one G. 12. M. The difference is 24. M. Of these you must take such part proportionally, as the 38. minuts beareth vnto 60. which are almost two terces of a degre: Then the two terces of 24. or 16. which must bee taken from one degrée 36. minutes, which correspond to the 26. G. of Virgo, because the declinations goe decreasing, and remaineth 1. G. 20. M. and if the declinatiõs increase, you must adde thereunto, as you take away when they decrease.

Another example for this yeare of 1561.

Example for the yere 1561. the 20. of Aprill, I find the true place of the Sunne at noon, in 9. degrees 54. minutes of Taurus, then in the table of the signes before, I seek for 9. degrées of Taurus, to which doth answere for the declination 14. degrees 32. minuts, and to the next degrée following doth answere 14. degrées 51. minutes, then take

the

the letter out of the more, so resteth 19. minutes. Then forme a rule of three, and say: if 60. minutes giue 54. minutes, (which 54. minutes doeth rest before of the 9. degrees of Taurus) how many doth 19. minutes giue, which 19. minutes are the diuersitie of the 9. and 10. degrees of Taurus. So I finde that 14. minutes giueth 17. minutes, and 6. seconds, which 17. minutes and 6. seconds, I adde to the 14. degrees. 23. minutes, which answereth to the 9 degrees of Taurus. And it commeth to 14. degrees 49. minutes, and 6. seconds, which is the true declination of the 20. day of Aprill, Anno. 1561.

It is also to be noted, that I adde these 17. minutes and 6. seconds, because the declination doeth increase: for if it decreased, it were to bee taken out so much, and the rest is the declination. So is the declination for the twentie of Aprill, in the yeare 1561. fourteene degrees, 49. minutes, and sixe seconds.

FINIS

AT LONDON.

Printed by Edward Allde, and are to bee ſolde by Hugh Aſtley, dwelling at Saint Magnus corner.

Anno. 1596.

A

DISCOVRSE

OF THE VARIATION

of the Compaſſe, or

Magneticall

Needle.

Wherein is Mathemati-

cally shewed, the manner of the obſeruation, effects, and application thereof, made by *W. B.*

And is to bee annexed to the newe Attractiue of *R. N.*

Imprinted at London by

E. Allde for Hugh Aſtley,

dwelling at S. Magnus

Corner. 1596.

To the trauailers, Sea-men, and Mariners of England.

HAuing of late gentle (Reader) receiued from the expert Artificer, Robert Normã, his booke entituled: The new Attractiue (who of the great good wil & affection he beareth, hath attributed in his dedication, that which I acknowledg not to be due) in the which amõgſt other diuers vertues & properties of the Magnes or Loadſtõe, he entreateth of the declining of the Needle touched therwith, from the plain of the Horizon, (a matter neuer before found or writtẽ of by any.) For the further behoue & benifite of all trauailers and Sea-men, I took occaſiõ to enlarge the ſame with this diſcourſe of the Variation or the Compaſſe, wherein I haue handled the whole variety of that ſubiect, both practically, and Mathimatically, to the end I might partly ſatisfie both the vulgar and alſo the learned ſort. For knowing the variation of the Compaſſe, to be the cauſe of many errors and imperfections in Nauigation, and perceiuing that al thoſe that haue as yet gon about to giue rules in that art, haue left this (being a principall point, and euen the ground of all the reſt) vntouched, or at leaſt ſo ſlightly handled the ſame, that little or no benefite could be gathered thereby: I haue heere ſet downe the ſundry waies to obſerue the ſame at all times & places, that the inconuenience being known, might be cõſidered off, and auoided Wherin, although my chiefeſt intent hath been to pleaſure thoſe that ſhal haue occaſion to put the thing in practiſe by their owne trauaile and experience, yet becauſe ſome of the rules are deducted from the

fountaines of the Methematical *Sciences*, and wrought by the Doctrine of Signes and Triangles, which maye ſeeme ſtraunge in our Engliſh tongue, & wherwith few Sea-men are yet acquainted, I may ſeeme to haue miſſed of my firſt good meaning, but I wold wiſh thē to chooſe that which is plain and conformable to their capacities, & make their profit thereof, and for the reſt vnderſtand, that of ſuch obſeruations as they themſelues cannot preſently apply to the purpoſe, by others, that are throughly inſtructed in theſe Mathematical ſupputations, or by themſelues when they ſhal attaine to the knowledge therof, may be inferred ſuch effectuall matter, as is by theſe rules & precepts promiſed. Wherfore I would haue al Sea-mē to vſe ſuch diligence in their trauails, that no opportunity be omitted whē, or wher any obſeruatiō may be made, either for the variatiō, or latitude of places, or any other neceſſary point incident to Nauigation, & therof to keep continuall notes & memorial. For theſe obſeruations there needeth not many troubleſome inſtruments, onely for the variation, the new inſtrument in the end of this treatiſe I preferre before all other. And for eleuations, a plaine Aſtrolobe exactly made, & a croſſe ſtaffe are ſufficiēt. (The Globe wer alſo a very good & neceſſary inſtrument: for beſides many pleaſant concluſions that may be tried by it, it doth lighten very much the conceits: for vnderſtanding diuers importāt points, but it is too troubleſōe (or otherwiſe not fit for euery Marriner) to be caried to the ſea. Vnto the which may be added the Topographical inſtrumēt, for taking of diſtāces, & making deſcriptions vpō the land. With theſe inſtruments, and the ſailing compas and Marine plate, (which are alwaies to be vnderſtood the principal, and moſt neceſſarie inſtruments for Nauigatiō, for by them only, any voyage may be made, but without them no Nauigation can be performed,) the whole worlde may be trauailed, diſcouered, and diſcribed. Theſe are ſufficient for a perfecte Mariner, and more then theſe wer ſuperfluous, only the running glaſſes, leads, lines,

and

and ſuch like appendances, of other excepted.

But to haue all theſe inſtruments, and not to vnderſtand the grounds how to vſe thē, were a great vanity. Therfore I wiſh al ſea-men & trauailers, that deſire to be cunning in their profeſsiō, firſt to ſeek knowledge in Arithmatike, & Geomatry, which are the groundes of all ſciences, and certain arts, of the which ther is written in out Engliſh tong, ſufficient for an induſtrious & willing minde to attaine to great perfection: whereby hee may not onely iudge of Inſtruments, Rules, & precepts giuen by other, but alſo be able to correct them, & to deuiſe new of himſelf. And this not onely in Nauigation, but in al Mechanical Sciences. As by the ſtudious practiſe and exerciſe in theſe Arts, haue attained to rare & ſingular knowledge: In Architecture, Vitruuius the Romain, in painting that famous Germain Albertus Durerus: and in building of ſhips, Mathew Baker our country-mā: & others in other faculties, as they haue bene moſt ſkilfull herein, ſo haue they excelled. Hauing theſe helps & groundes, with the inſtruments before ſpecified, a Mariner may be able to make deſcriptiō in plat of the coaſts and countries, & of the banks, rocks, & ſholds in the ſea, with the depths, & other neceſſarie notes obſerued in his owne trauails, perticulerly & effectually according vnto the truth (which is the chiefeſt part required in a perfect Mariner.) And not be alwaies tied to the reportes of other, or to the Portugale, or ſpaniſh Marin plats, which are made by the card-maker of thoſe countries, men that are no trauailers themſelues, but doe al things therein, by information, & vppon the credite of others, which onely commit to memory the forme & maner of the Sea coaſts, with making ſome few notes of the lying of one place frō another, which can neuer be ſo perfect, as the deſcriptions that are made vpō the preſent ſight and view of places, albeit he be neuer ſo skilfull and cunning, that ſhal ſo carrie the ſame by memorie; how much les thē by the vnskilful: by this meās ꝑ card makers ſet down they know not what,

as maye appeare by the deſcriptions of their owne coaſtes, which are verie groſly and vnperfectly done, whereas the marin Plats ought to be deſcribed by ſuch as can giue reaſon, & ſhew obſeruation of euery perticulatitie contained in the ſame, aſwell for the latitude of places, as the lying by the compaſſe of the Capes, Head-landes, pointes, Ilandes, Baies, Rocks, Sholds, &c. one from an other, and the diſtances between them. The errours of thoſe deſcriptiõs, I may not attribute to the card-makers, but to the vnskilful ſeamen of thoſe countries, for if they were otherwiſe, as they haue been accounted the moſt skilfull of the world, thoſe errors could not haue cõtinued as they do: tru it is, that for their great trauails, they haue been worthily famous aboue all other nations, till now at length our Country-man Sir Frances Drake, for valarous attempt, prudent proceedings & fortunat performing his voyage about the world, is not onely become equall to any of them that liue, but in fame farre ſurmounteth them all. But thoſe card-makers, and al other that collecte and gather Hydrographicall, and Geographical deſcriptions of other mens trauails or reports: as their paines may be great, and deſerue due comendations, ſo their doings may bring cõmoditie diuerſly. And in this behalf Abrahamus Ortelius in his Theatrum, hath deſerued immortall praiſe, for collecting together, and reducing into one commodious volume, the dyuerſe Plats and deſcriptions, made by diuers & ſundry men. But amongſt al thoſe that haue made Geographical deſcriptions, I cãnot a little meruel at Gulielmus Poſtellus, who being a famous learned man, a great trauailer and Coſmographer, & deane of the Kinges profeſſors in the Vniuerſity of Paris, in his vniuerſal Map, An. 1580 beſides that, it is generally handled after ſuche a groſe and confuſed manner, that it might ſeeme rather to haue come from ſome rude vnskilfull, thẽ from him ſo famous a Doctor, hath alſo in the imagined Countries about the Norrh *Pole*, ſo corrupted it with his fond dreams, & fãtaſtical inſcriptions, attributing to thoſe

ſuppo-

ſuppoſed lands, diuers people, as the Georgians & Hyperborians, and aſsigning there to bee the higheſt hilles of the world, and the people dwelling on them, to haue the cõtinuall light of the Sun, Sueta, Zemlia found by the engliſhmen, An. 1550. the holy Land, the place of the chiefeſt felicity, the Hiperboreã fields, & therfore the felicity of the Molucca's, with many other ridiculous abſurdities: That by the groſe errors of this learned man in theſe matters, I am taught, that whatſoeuer fame goeth, or opinio is conceiued of any man for profound learning, and ſmooth deliuering of their conceits, or whatſoeuer great promiſes are by theſelues made in theſe artes, to iugde of thẽ according to the works that come frõ thẽ, & not otherwiſe to be deceiued.

For auoiding prolixitie in this my *Preface* to ſo ſmall a volume, I referre thee gentle Reader, to the worke it ſelfe. Yet by the way it ſhall not be amiſſe, that I cõmend vnto you the Table of the Suns declinatiõ (or Regiment) made by R. N. which is calculated for the preſent time, & differeth not from the truth in any place aboue one minute, wheras in al other hetherto made & extant, there are great errors. Therefore, ſuch as otherwiſe cannot from time to time calculate their declinatiõs, according to ỹ place of the *Sunne* to be giuen by the Ephemerides, and table of declination of Reinholdus, may boldly vſe this regiment for 20 yeares, without any ſenſible error. And ſo wiſhing my trauailes in this treatiſe, may do ſuch good as I meant, I commit the ſame to your gentle conſtructions, & your ſelues to the Almightie. At Limehouſe the 26. of September.

Anno. 1581.

William Borough.

¶ A Table of the chapters contained in the Treatise. following of the variation of the Compass

The first Chapter.

OF the Variation of the Compasse or Magneticall Needle.

The second chap.

The manner howe to vse the Instrument of variation.

The third chap.

How to finde the Variation of the Compasse or Needle at any place, the eleuation of the Pole, & the scituation of the meridian vnknowne.

The fourth chap.

The eleuation of the pole, and place of the Sunne giuen, how vpon the globe, to finde the Variation of the Needle by anye one obseruation, either in the forenoone or afternoone.

The fift chap.

Howe to finde the Variation by Arithmeticall calculation, vpon any one obseruation, in forenoon or afternoon, the latitude of the place and declination of the Sunne beeing giuen.

The sixt Chapter.

Another way most generall, how to finde the Variation by one obseruation, either in forenoone or afternoone, the eleuation of the pole, and Declination of the sunne, being giuen.

The seuenth

¶ Of the Variation of the Compasse or magneticall Needle.

Chapter. 1.

THE Variation of the Needle or Compasse, is properly the Arke of the Horizon contained betweene the true Meridian of any place, & the Magneticall Meridian of the same, and is denominated to bee Easterly, or Westerly, according to the position of the Magneticall Meridian to the Eastwardes or Westwardes of the true Meridian: And may be accounted either from the North parte, or the south parte thereof, but vpon oppolite points it hath contrary denominations.

The Magneticall Meridian, is to be vnderstood a great circle passing by the Zenith and the Pole of the Magnes, deuiding the Horizon into two equall parts crossing the same at oppolite points: which intersections or crossinges, are shewed by the Needle, or wiers of the Compas, touched with the Magnes or the Loadstone.

The Azimuth of the Sunne is a great circle, passing by the Zenith, and the true place of the Sunne: crossing the Horizon at right angles in oppolite points, and diuiding the same into two equall partes, and it is saide to bee giuen when the distaunce thereof from the true Meridian is knowne.

The Azimuth of the Sunne vppon equall eleuations in forenoone or afternoone, haue equall distaunces from the true Meridian, so that the middle point of the whole difference of any two Azimuths obserued vpon equal eleuations in forenoone or afternoone, is the true Meridian.

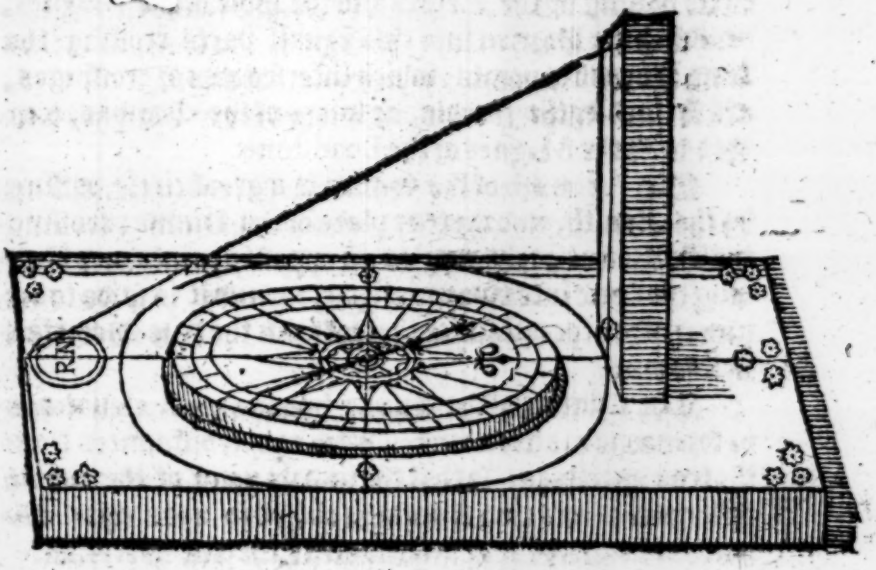
This difference of Azimuths, is found vpon the Instrument

ment of Variation, by adding together the Variations of the ſuns ſhadowe, at equal eleuations in the forenoone and afternoone. The halfe whereof is the diſtaunce of the Azimuths from the true Meridian: the which compared with either of the ſame Variations of the ſunnes ſhadowe, the difference ſhall bee the Variation of the Needle, from the true Meridian.

Or els ſubtracting the leſſer variation of the Sunnes ſhadowe, from the greater (at equall eleuations) the halfe of the remainer ſhall bee the true Variation of the Needle from the Meridian.

But the Azimuth of the Sunne being otherwiſe giuen, and the Variation of the ſhadow likewiſe giuen, the difference betweene them, is the variation of the Needle.

The Variation of the Sunnes ſhadow, I call the Horizontall diſtaunce betweene the Azimuth of the Sunne, and the Magneticall circle, which are repreſented in the Inſtrument, by the ſhadowe of the line, and the Needle.



The

Of the Variation

The second Chapter.

The manner how to vse the instrument of Variation.

Irst you must place the instrument vpon some stoole, or other thing that is flat, so as it may stand leuell, & the Plummet in the Standerd which is placed at the North end of the fixed Flie, may fall perpendicularly, with the line in the same Standard.

You must haue regard that in remouing the instrument to the sunne as hee goeth about, it may alwayes stande leuell as afore said.

You are then to consider, that the string that reacheth from the south parte of the Instrument to the top of the standard, is the chiefest string to giue the sunnes shadowe which must be so directed by turning the Instrumentes South side to the Sunne wards, that the shadowe of the same maye fall directly longst vppon the lyne of South and North in the fixed Flye, for it ought not to crosse or decline from the same lyne in any part, but if it do, you must seeke to reforme it, by setting the standard more vpright, or remouing it at the south end.

Then must you also see, that the string that is fastned to the hoope of Brasse that inuironeth the fixed Flye, may bee so placed that it agree Iustly with the shadowe of the former lyne, and the lyne of south and North in the fixed Flie, in such sort that both the shadowes may be as it were hidden in the said line of the Flie: which you may do aptly by turning the said hoope, and remouing the same lyne at either side of it, as you shall see cause.

The Instrument being duly placed in forme afore said, it differs nothing from the Compasse of Variation, but onely in this point, that whereas the Flie of the compasse of Variation, is so turned by vertue of the Magneticall wiers,

wiers, that the Northy point thereof dooth ſhewe the Pole of the Magnes, or line of Variation. In this Inſtrument, the Northy point of the Needle dooth ſupplie that, which the Northy point of the compaſſe ſhould doo. And the Northy point of the Flie which is fixed in the bottome of the Inſtrument, dooth alwaies aunſwere to the ſhadowe that the Sunne gineth.

The third Chapter.

How to finde the variation of the Needle or Compas at any place, the eleuation of the Pole, and ſcituation of the Meridian vnknowne.

When you would obſerue the variation in any place, you muſt begin in the forenoone the ſooner the better, and the more effectuall may your obſeruations bee, doe thus. Take your Aſtrolobe, and obſerue dulye the height of the Sunne, for your more eaſe it ſhall be beſt for you to note the ſame, when it agreeth to be iuſt vpon a degree, without any conſideration of minuts, or fractions, and at the inſtant of the ſame height, turne your inſtrument to the Sunne, ſo as the ſhadowe of the lines may fall iuſtly vppon the line of the ſouth and northy in the fixed Flie.

Then, when the Needle doth ſtand, looke directly ouer the Northy point of the Needle, what degree and fraction, (if there be any) doth anſwer vnto ỹ ſame in the fixed flie, that is to ſay, howe many degrees it is from the Northy of the fixed Flie, which you ſhall note diligently, and maye ſay, that ſo many degrees, &c. is the variation of the Suns ſhadow from the Northy, as the Northy point of the Fly is from the Northy point of the Needle, either Eaſtwards or Weſtwards as you ſhall finde the ſame. Thus may you obſerue diuers times, vpon ſeuerall degrees of the Suns

eleuation

elevation. And like as you do in the forenoone, so must you also obserue the Sunnes elevation in the afternoone vpon the same degree of height, and with the same side of the Astrolobe and Index turned towardes the sunne, as it was in the forenoone (for auoiding of errour that may bee in the Instrument) noting at euery height, what you finde the variation. And when the Sunne commeth to the Meridian, it shall be good that you exactly obserue his elevation vpon the same, for knowing the true latitude of the place: all which you shall set downe in forme following.

Example.

In Limehouse the sixteenth of October, Anno. 1580.

Forenoone.			Afternoone.			
Elevation of the Sunne.	Variation of the shadowe frō the North of the Needle to the Westwards.		Elevation of the Sunne.	Variation of the shadowe frō the North of the Needle to the Eastwards.		Variation of the Needle frō the Pole or Axes.
Deg.	Deg.	Min.	Deg.	D.	M.	D. M.
17	52	35	17	30	0	11 17½
18	50	8	18	27	45	11 11½
19	47	30	19	24	30	11 30
20	45	0	20	22	15	11 22½
21	42	15	21	19	30	11 22½
22	38	0	22	15	30	11 15
23	34	40	23	12	0	11 20
24	29	35	24	7	0	11 17
25	22	20	25	Fro N. to W. 0. 8.		11 14

The

The eleuation of the Sunne vpon the Meridian. 25. d. 58′. the declination 12. d. 30′. which I adde to the eleuation, because the Sunne hath south declination, and therof amounteth 38. d. 28′. the eleuation of the equinoctiall, the which I substract from 90. d. the rest is 51. d. 32′. the eleuation of the Pole Artike.

Now are you to consider, that out of the greate Variation of a shadowe vppon any degrée of the Sunnes eleuation, is to be taken the lesser of the same degrees eluation, whether it bee in the forenoone or afternoone (except the same variations bee both one way from the North of the Néedle, which then are to be added) the halfe of the remainer, is the variation of the Needle, or Compasse, from the Pole or true Meridian.

In the former obseruations, I do finde the greatest variation in the forenoone, for at 17. d. eleuation, the variatiõ is 52. d. 35′. from North to West: And at the same eleuation in the forenoone, I finde the variation to bee but 30. d. 0′. from North to East. I take the lesser out of the greater, and finde remaining 22. d. 35′. the halfe thereof is 11. d. 17′. ½. So must I say to the Pole Artick, and true Meridian line that passeth to the pole, by our Zenith at London, to the Westwards of the North that the Néedle sheweth. And therfore the Néedle or Compas varieth from the true north, 11. d. 17′. ½. to the eastwardes.

Also at 25. d. eleuation in the forenoone, the variation is 22. d. 20′. from North to West, at the same eleuation in the afternoone, the variation is. 0. d. 8′. from North to West. Now because the variations are both one waye, (that is to the Westwards) I adde them together (and so ought you to doe, as often as you finde the variations so to agrée) & I finde that they amount to 22. d. 28′ the halfe thereof is 11. d. 14′. which is the variation.

The variations of the Néedle or compas by the former obseruations, are set out towardes the right hande against euery degrees eleuation, and conferring them altogether,

I doo finde the true variation of the Needle or Compas at Limehouse to be about 11.d ½ or 11.d ¼ which is a point of the Compasse iust or little more. So that in a Compas whose wiers are set directly vnder the flowre de Luce, the North, and by West, and South and by East pointes doo shew the true Meridian.

The eleuation of the Pole, and place of the Sunne, giuen, how vpon the Globe, to find the variation of the Needle by any one obseruation, either in forenoone or afternoone.

The fourth Chapter.

IN the former declaration, the onely waye to trie the variation, is by comparing of the seuerall correspondent obseruations of the Sunnes eleuation in the forenoone, with those of the afternoone, so that if the Sunne should be obscured, or by any other occasion like obseruation cannot be made in the afternoon, then the former rule giueth not the desired purpose. Therfore I thought good to shew, howe by anie one obseruation in the fore or afternoone, the eleuation of the Pole & place, of the Sunne giuen, you may knowe the true Meridian and the variation of the needle from the same in any place which thing may be done and aptly demonstrated vpon ỹ Globe, but most exactly calculated by the Table of signes.

To finde out the variation vpon the Globe, you must first set your Globe to stande duely according to the eleuation of the Pole at the place proposed. Then seeke in the Ephemerides, for the true place of the Sunne that day, and note it with some small pricke in the Ecliptick of the globe And placing the Quadrant of altitude or moueable verticall, at the verticall point or Zenith, take the eleuation

of

of the sunne obserued by the Astrolobe or other Instrument at the time proposed, and note it iustly vppon the same Quadrant of altitude. Then turne your Globe and Quadrant towards that parte of the Horizon that the sun was in at the time of the obseruation, tyll the pricke you made for the place of the sunne in the Eclipticke, concurre and agree iustly with the elsuation marked in the sayde Quadrant of altitude: so shall you see the Quadrant shew you vppon the Horizon, the Azimuth and distance of the sunne from the true Meridian of that place, which you shall compare with the variation obserued vppon the Instrument at that instante of the Sunnes elsuation. And if they agrée and concurre iust, then shall you be in the true and common Meridian, which sheweth the Pole of the world, and Pole of the Magnes or Loadstone. But if they differ, you shal subtract the lesser from the greater, the remainer sheweth the Variation. And if the variation vpon the Instrument be greater then the true distance of the Azimuth from the Meridian found vpon the globe, the same surplu[illegible] be accounted for variation: vpon the contrarie side of the Meridian: if it be lesse, it is to be accounted on the same side of the Meridian that the variation is taken, whether it be in the forenoone or afternoone. This precept néedeth no further demonstration, then the instrument it selfe, the Globe I meane.

But for example of the worke, I take the firste obseruation, in the former Chapter specified, made at Limehouse, the sirteenth of October. 1580. in the forenoone, which is 17.d. elsuation & variation 52.d.35′. from North to West.

First I set my Globe at 51.d.32′. for the elsuation of the Pole. Secondly, I take the place of the Sun 2.d.55′.m. and note it vpon the Eclipticke. Thirdly, I note vpon the Quadrant of altitude, the elsuation of the sunne. 17.d. This done, I moone the quadrant of altitude towards the East of the Horizon, and turne the Globe till the pricke in

the Eclipticke for the place of the Sunne, do agree iuſtlie, with the eleuation noted vpon the quadrant of altitude, & find the true azimuth ſhewed by the ſame quadrant vppon the Horizon to bee neereſt, about 41.' from the Meridian: and conferring the ſame with the variation found vppon the Inſtrument 52.d.35'. I finde the difference 11 d.15' and becauſe the obſeruation is noted to be in the forenoone from the North to the Weſt, or South to the Eaſt, and the variation vpon the Inſtrument greater then the azimuth found on the Globe, I account the ſame from the North to the Eaſt, or from the ſouth to the Weſt. So I conclude the variation at Limehouſe to be about 11.$\frac{1}{4}$ from North to Eaſt, or ſouth to Weſt.

How to finde the Variation by Arithmeticall calculation vppon any one obſeruation in the forenoone or afternoone, the latitude of the place, and declination of the Sunne being giuen.

The fift Chapter.

THe ſumme of the woorke is to finde the arke of the Horizon betweene the meridian and the azimuth of the ſunne at the time of the obſeruation, which being compared with the variation found in the Inſtrument, the difference is the Variation of the Needle. For attaining of the ſame arke. Firſt it is neceſſarie to haue the arke of the Equinoctiall betweene the ſunne at the time of the obſeruation, and the meridian, which arke is thus found.

Multiplie the ſigne of the Sunnes Meridian altitude for the day propoſed by the whole ſigne, the product deuide by the ſigne of the eleuation of the Equinoctiall (or the complement of the latitude) the quotient is the hearſed ſigne or ſhaft of the Semidiurnall arke, which you ſhall note

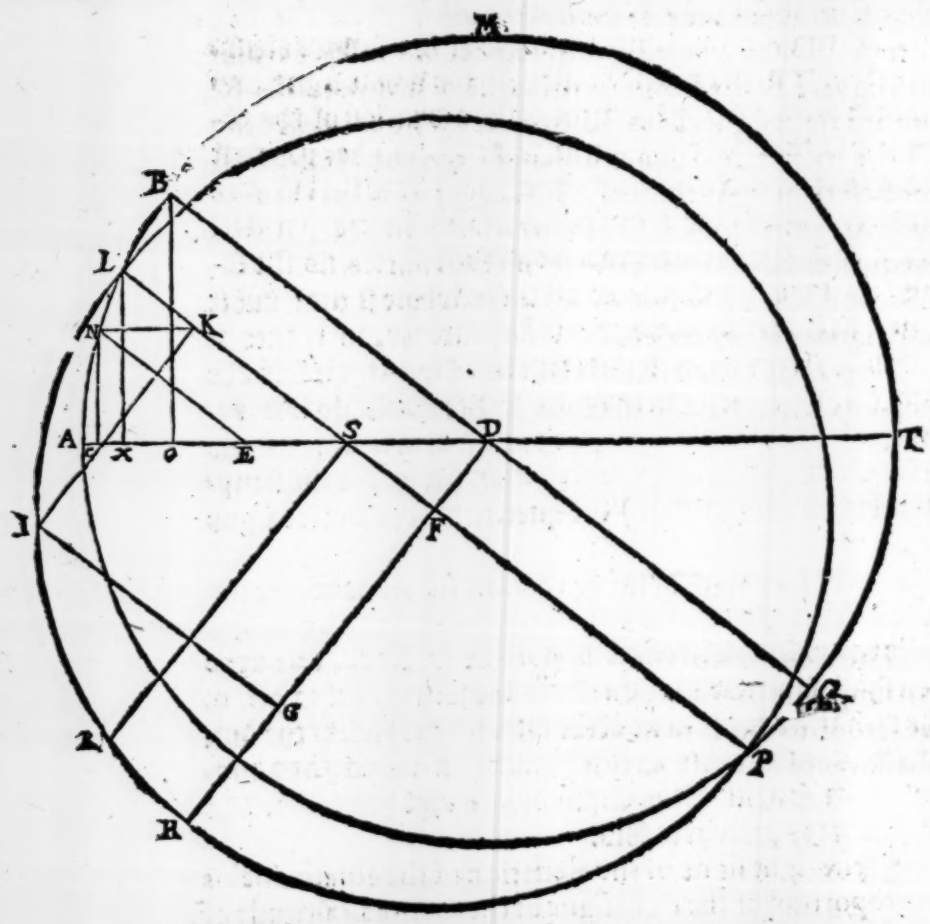
note for the first number.

Then againe multiplie the signe of the sunnes eleuation at the time of the obseruation, by the whole signe, and the product deuide by the signe of the eleuation of the Equinoctial, the quotient subtract from the number you first noted, the rest is the versed signe of the arke of the distance betweene the sunne and the Meridian in the paralell that it is in for the time proposed, in such partes as the semidiameter of the Equinoctiall is the whole signe: but it is necessarie before you apply it any further, to reduce it into such partes as the semidiameter of the paralell is the whole signe, which you may doe thus: Multiply this remainer by the whole signe, the product deuide by the signe of the complyment of the declynation (which is the semydiameter of the paralell) the quotient is the versed signe in his proportionall partes.

This versed signe thus reduced and subtracted from the whole signe, leaueth the second right sign, which you shal seeke in the Tables of signes, and thereby finding his arke you shall subtracte the same from the Quadrant or 90. d. the remainer is the arke of the foresaid paralell of the sun, which is answerable or correspondent in degrees and mynutes, to the arke of the Equinoctiall that you seeke. The reason of the precept is this.

As the right signe of the eleuation of the equinoctial, is in proportion of the right signe of the meridian altitude of the sunne or any star: so is the whole signe, to the versed signe of the semidiurnall arke. And again, as the right sign of the meridian altitude, is to the right signe of the eleuation of the sun or star at the time of the obseruatiõ, so is the versed signe of the semidiurnal arke of the same, to the excesse or difference between the same versed signe and the versed signe of the distance from the meridian.

For the better vnderstanding of the premises, I haue set downe this figure following, and wish the Reader to consider of the same with the 4. Pro. of the 6. of Euclide.



LEt AMT. bee the meridian circle. BDQ. the common ſection of the meridian, and Equinoctiall theyr plaines, which is alſo the diameter of both circles.
ADT. the plaine of the Horizon. LHP. the paralell of the Sun, which is deſcribed vpon the center F. at the diſtance FL. which is the ſign of the complement of the declination AB. the arke of the eleuation of the Equinoctiall BO. the firſt right ſigne thereof AL, the arke of the meridian altytude LX. the ſigne thereof. AN. the arke of the Sunnes

eluati-

eleuation at the time of the obſeruation. NC. the ſigne thereof BD. the whole ſigne in reſpect of the former arkes and ſignes LR the Semidiurnall arke of the paralell. RS. the firſt right ſigne therof SL, the verſed ſigne of the ſame. LI, the arke of the Sunnes diſtance from the Meridian IK the firſt right ſigne thereof. IG. the ſecond right ſigne which is equall to KF. KL. the vearſed ſigne NE. whych is equall to KS. the difference of the twoo verſed ſignes. LS. and LK, LF. the whole ſigne in reſpect of the arkes and ſignes of the paralell.

Now as BO. is to LX. ſo is BD. to LS. And as LX. to NC. ſo is LS. to NE. Or elſe thus, As BO. to NC. ſo is BD to NE.

Example.

The 16. of October 1580. in Limehouſe.

The eleuation of the pole Articke 51. d. 32′. The declination of the ſunne 12. d. 30′. The eleuation of the ſunne obſerued in the forenoone. 17. d. 0′. The variation of the ſhadow vpō the inſtrument 52. d. 35′. from north to weſt.

′	38.28′.	90.0′.	25.58′.	
	BO.	BD.	LX.	LS
If	62205.	giue 100000.	—then 43784.	giueth 70386.
	38.28′.	90.0′.	17.0′.	
	BO.	BD.	NC.	NE.

Againe, if 62205. giue 100000. 2937. ſhall giue 47001.

Now out of LS. —70386.
take NE—47001.
Reſt LK.—23385.

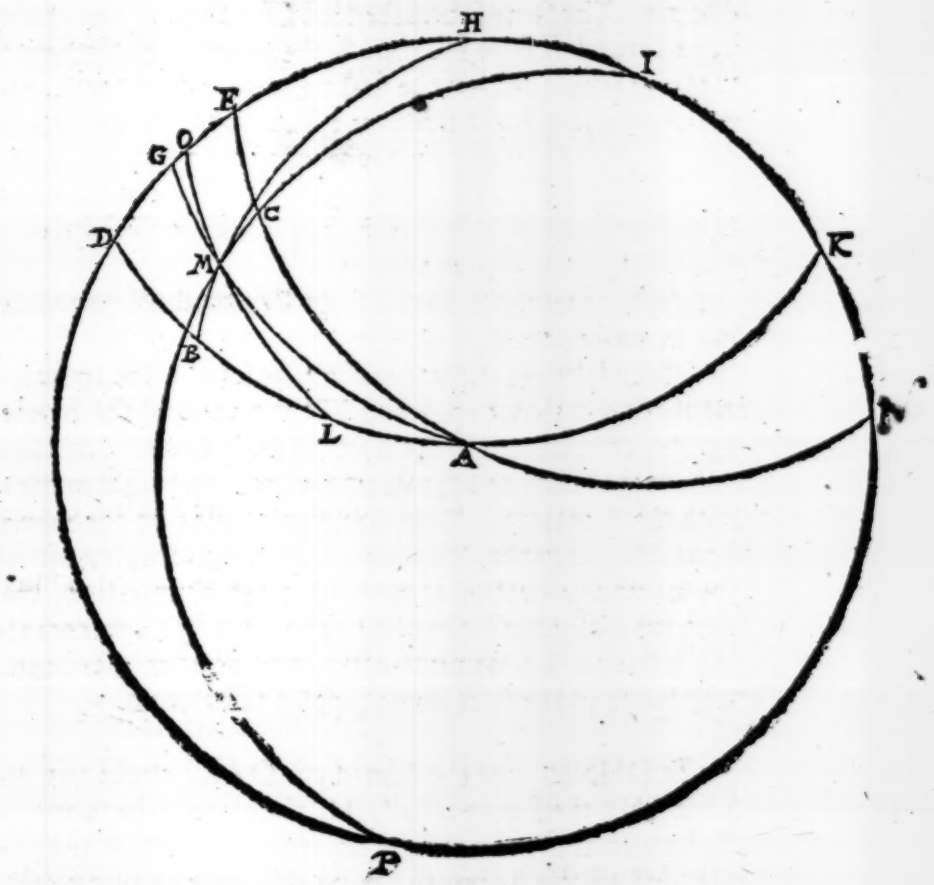
Then if LF. 97629. the ſigne of 77. d. 30′. the complement of the declination, giue LF. 100000 then IK. 13385 giueth IK. 23952. the vearſed ſigne of the Arke IL. is his

due parts. The ſame ſubtracted frō LF. 100000. the whole ſigne, leaueth KF. or IG. 76048. the ſecond right ſigne of the ſame arke, which is the firſt right ſigne of the arke IH. which arke you ſhall finde in the Table of ſignes to be 49. d. 30'. 24''. the complement wherof to the quadrant is 40. d. 29'. 36''. the arke IL. of the paralell betweene the ſun & the meridian, whoſe coreſpondent arke in the Equinoctiall, is the arke that was ſought.

Nowe hauing this arke of the Equinoctiall, you muſt worke as followeth.

Multiplie the ſigne therof, by the ſigne of the complement of the declination, & deuide the product by the whole ſigne, the quotient is the ſigne of an arke contained betweene the ſunne and the Meridian, making right angles with the Meridian. This ſigne multiplys by the whole ſigne, the product deuide by the ſigne of the complement of the Sunnes eleuation at the time of the obſeruation, the quotient ſhalbe the ſigne of the arke of the Horizon contained betweene the Azimuth of the Sun, and the Meridian, which is the arke that was propoſed to be found.

LEt DHNP. bee the Meridian. DAK. the Horizon. EAN. the Equinoctiall. M. the place of the ſunne in the heauen at the time of the obſeruation. LMO. the paralell. HMB. the Azimuth or verticall circle paſsing by the Sunne. A*M*G, a great circle imagined to paſſe by the ſunne, and to croſſe the meridian at right angles. I*M*P, a great circle paſsing by the poles of the world, and place of the ſunne at the time of the obſeruation, commonly called the circle of houres, or circle of declination. CM. the ſouth declination of the ſunne. MP. the complement therof to the quadrant. *M*G. the arke betweene the ſunne and the *M*eridian of the former imagined circle. A*M*G*M*O. the Arke of the ſunnes paralell. EC. the correſpondent arke of the Equinoctiall, which are giuen in the former work. MB. the Eleuation of the ſunne at the time of the obſeruation.



tion. *M*H. the complement thereof. BD. the Arke of the Horizon intercepted betweene the Azimuth and the *M*eridian, whiche is the thing required to bee found.

In this figure the Reader is to conſider the manner of the ſpherical triangles, and to compare the ſignes of their ſides, according to the doctrine of Copernicus, in the 14. Chapter of his firſt booke, & of Regiomontanus, his 25 and 27. Propoſitions of his 4. booke of triangles.

As PC. is to CE. ſo is PM. to MG. but three of them are

giuen, therefore the fourth shalbe knowen.

And as HM. is to MG so is HB to *BD* the arke that is sought, which by three first giuen is likewise giuen.

The second part of the example.

90.0′	40.29′.36″.		77.30′.
PC.	EC.	PM.	*MG.*
If 100000. giue	64935.	—— then 97629.	giueth 63395.
37.0′.	90.0′.		41.31′.22″.
HM.	MG.	HB.	*BD*
Againe, if 95630. giue	63395.	—— 100000.	giueth 66291.

Whose arke *BD*, 41.d 31′.22′. is the Horizontall distance of the Azimuth of the Sun from the *Meridian*, the thing that was sought.

Nowe comparing the same with the variation founde vpon the Instrument at the instant of 17. d. eleuation which is 52.d.35′. I finde it to be lesse, and therefore substract it, and so haue I the difference 11.d.3′.38″. And because the obseruation was in the forenoone, and the variation vpon the instrument greater then the arke of the Horizon, betweene the sunnes azimuth and the Meridian, therfore I conclude that the variation is 11.d.3′38″. frō South to West, or North to East, which is the thing promised to be shewed.

But comparing the same arke of the Horizon 41.d.31′ 22″. with the variation found at the correspondent eleuation in the afternoone, which is 30 0′. I substracte the lesser from the greater, & find the excesse 11.d.31′22′. which should be the variation. And because the variation found vppon the Instrument is lesse then the arke of the azimuth vppon the Horizon, I accouut the variation on the same side of the Meridian, which is from South to West, or North to East.

This varietie betweene the obseruation made in the fore-

forenoone, and that in the afternoone, proceedeth either of the imperfection of the instrument, or negligence of the obseruer. For in the rule there can be no error, being grounded vppon Geometricall demonstration, then which, nothing can be more certaine.

The former precepts and examples do serue when the sunne dooth decline from the Equinoctiall either Northwards or southwards. But if the sunne be in the Equinoctiall, then the manner of the woorking is more easie and briefe. For if you multiply the signe of the Sunnes eleuation at time of obseruation, by the whole signe, and deuide the produce by the signe of the eleuation of the Equinoctiall, which is the meridian altitude, the quotient giueth the second right signe of the distance of the sun from the meridian, which is the first right signe of the complement of the same arke: and entring the Table of signes with it you shall finde his arke, which if you subtract from the Quadrant or 90. d. leaueth the arke of the distance of the sunne from the meridian. And hauing the same worke thus. If the signe of the complement of the eleuation of the sunne at the time of the obseruation, giue the signe of the forsaid arke of distance, what shall the whole signe giue? Multiplie and deuide, the quotient shalbe the signe of the arke of the Horizon contained betweene the Azimuth of the Sunne and the Meridian. Which arke being compared with the Variation of the Instrument in manner as before is shewed, giueth the variation required.

But the sunne being in the Equinoctiall, if the place wher the obseruation is made, be likewise vnder the same circle, then is the variation most easily obserued, for that the Equinoctiall is the azimuth of East and West, therefore turning your Instrument onelie to receiue the shadowe of the Sunne, and looking then to the North point of the Needle, if you finde the same to aunswere to the Quadrant or 90. d. you shall bee in the Meridian of the Magnes, which passeth by the Poles of the world, but if it doe

doe differ from 90. d. the same difference is the variation of the needle.

But admitting the obseruer to be vnder the Equinoctiall, and the sunne to haue Declination, then the proportion of the signe of the complement of the eleuation at the time of the obseruation, vnto the signe of the declination shalbe such, as the whole signe, is to the signe of the ark of the Horizon included betweene the Azimuth of East and West, which is the Equinoctiall it selfe, and the azimuth of the sun for the time of the obseruation, the complement wherof giueth the true Meridian, which complement you may compare with the variation shewed vpon the Instrument, the difference is the variation.

Diuers other cases might be proposed, and rules gyuen for them, which for breuity I omit.

But one thing I thought good to admonish you by the way, that whereas I haue shewed in the first parte of this proposition, the manner to finde the twoo vearsed signes, the one of the Semidiurnall arke, the other of the arke of the distaunce of the sunne from the Meridian. By the first the semidiurnall ark being found and reduced into houres and minutes of time, is shewed the iust halfe quantitie of the day. And by the arke of the other likewise reduced, the houre of the day, or the time contained betweene the noone tyde and the instant of the obseruatiō: as in the same example.

The versed signe of the Semidiurnall arke. LS is gyuen 70386. in such parts as the semidiameter of the equinoctial *BD* is 100000. therfore I reduce the same into such partes as the semidiameter of the paralell LF. is 100000. and finde it to bee 72095. whyche subtracted from the whole signe *LF* 100000. there resteth *SF* 27905. whych is the seconde right signe of the semidiurnall arke LR. and the right signe of RH 16. d. 12′. which is the complement of the Semidiurnall arke *LR* wherefore subtracting it from the Quadrant *LH* 90. d. resteth 73. d. 48′.

the

the Semidiurnall arke *LR* the same reduced into partes of time alowing 15.d. for a houre 15′. for a minute, & 15″ for a seconde of time, and for euerie degrée 4. minutes of time, for euerie minute 4″. and for euerie second 4‴. &c. I finde the time of that arke from the time ascendent, to the Meridian, which is halfe the day, to be 4. houres 55′ 12″. and consequently the whole day being the 16 of October aboue written, to be 9. houres 50′. 24″. long.

This example may serue for a general precedent, whiles the equinoctiall is betweene the sunne and the eleuated Pole, but if the sunne bee betweene the eleuated Pole, and the Equinoctiall, then will the versed signe fall out to bee greater then the whole signe, and the semidiurnall arke to exceede a Quadrant. Wherefore hauing reduced the same into his proportionall parts, as before is shewed: subtract from it the whole signe, the surplus is the signe of the excesse of the Semidiurnall arke aboue a Quadraunt, which being added to the Quadrant, giueth the semidiurnall arke.

By the other versed signe of the distance of the sunne from the Meridian, which is LK. 23952. in such partes as the whole signe or Semidiameter *LF* is 100000. subtracted from the whole signe, is giuen KF. 76048. the seconde right signe of the same arke of distance, and the first right signe of 49.d.30′.24″. which is the complement of the arke of the Sunnes distance from the Meridian: therefore subtracting the same from 90.d resteth 40.d.29′.36″. the arke of the distaunce betweene the sunne and the Meridian, which beeing reduced into partes of time as before, giueth 2. houres 41′. 58″. and the same (because it is in the forenoone) deducted from 12. houres the noone steed, resteth 9. houres 18′. 2″. the iust instant of the time of the daie.

But if this versed signe be found to be greater then the whole signe (as it may when the sunne is betweene the Equinoctiall and the eleuated Pole, and before the houre

or

or five in the morning, and after the houre of five in the euening) then dooth the arke of distance consequentlye exceede a Quadrant, the signe of this excesse is the surplus of the versed signe aboue the whole signe. Whose arke added to the Quadrant, giueth the arke of the sunnes distaunce from the meridian, and reducing the same into partes of time, is giuen the instant of time of the obseruation.

As by this meanes (the eleuation of the sunne beeing preciselye obserued and latitude knowne) the instaunt of tyme of the daye is gyuen more exactlie, then by anie Clocke, Diall, or other Instrument. Soif there might be had a portable Clock that would continue true the space of 40 or 50. houres together (if longer tyme the better) then might the difference of longitude of any twoo places of knowen Latitudes, which conuenientlye may be bee trauailed within that tyme, bee also most exactly giuen. And in this sorte trauailing and obseruing from place to place, might the Longitudes of any Countrie bee perfectlye described.

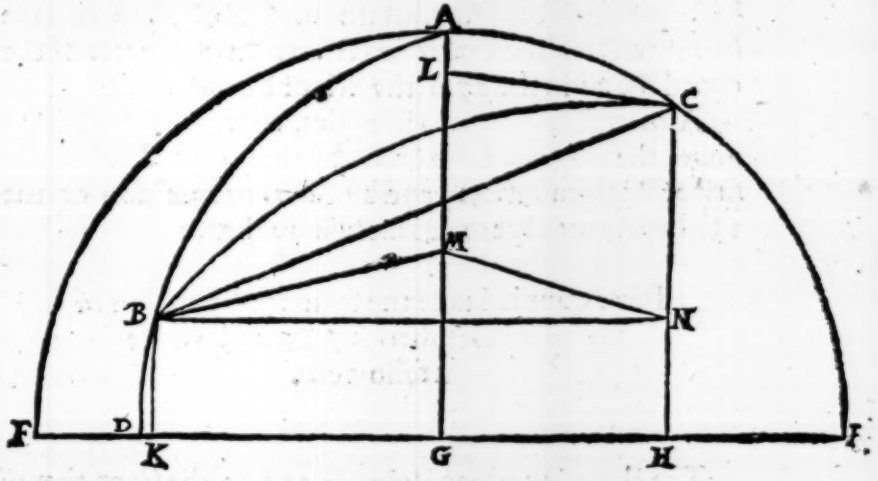
Another waie most generall, how to finde the Variation by one obseruation, either in the forenoone or afternoone, the eleuation of the Pole, and declination of the sunne being giuen.

The sixt Chapter.

For the accomplishing of this proposition you are to imagine a sphericall Triangle vpon the superficies of the Globe, whose sides must be. First, the portion or arke of the meridian betweene your Zenith and the Pole, which is the complement of the latitude. The second the arke of the verticle circle contained betweene your Zenith & the sun, which is the complement of the suns eleuation at the time of the obseruation.

The

The third side is an arke of the circle of declination comprehended betweene the sunne and the eleuated Pole, this arke is found by adding, or subtracting the declination of the sunne, to or from, the Quadrant or 90.d. which must be done with this consideration, that if you be on the same side of the Equinoctiall that the sunne is, you are to subtract the declination from the Quadrant. If on the other side, to ad it to the same, so haue you the three sides of the spericall triangle giuen. Then the substance of the worke consisteth in finding the quantitie of the angle of the same triangle at the Zenith, for the complement thereof to the Semicircle or two right Angles, is the Horizontall distance of the Sunnes Azimuth, from the Meridian, which beeing compared with the variation of the Sunns shadowe vpon the Instrument, giueth the thing required.



LEt FACE. be the Meridian, wherein A. the Zenith, C the Pole. AD. the verticall circle of Azimuth of the Sunne passing by B. the place of the Sunne at the tyme of the obseruation. BD. the eleuation of the Sunne. BA. The complement of the eleuation AC. the complemēt of the latitude. BC. the arke of the circle of declination, or the

the chord of the ſame arke. FGE. the plaine of the Horizon.

Now from the three angles of the triangle ABC. let fall 3. perpendicular lines to the plaine of the Horizon. AG CH. and BK. and by the 6. of the 11. of Euclide, theſe three lines ſhalbe paralels.

Then let fall a perpendicular line from C. vpon AG. in the point L. from *B*. another perpendicular vpon the ſame line AG. at the point *M*. And from the ſame point *M*. erect a perpendicular line to N, which ſhalbe paralell and equall to LC. Then ioine *B*. and N. together. So haue you a right lined triangle, *BM*N, whoſe angle at *M*. is equall to the angle A. of the ſphericall triangle *ABC*. By the 4. definitiõ of the 11. Euclide, for the like reaſon is of obtuſe angles as of acute or ſharpe. And the ſides thereof *BM*. and *M*N, are giuen *BM*. the ſigne of *B*A. and *M*N. equal to LC. the ſigne of CA. And the third ſide BN. is founde by ſubtracting the ſquare of NC. from the ſquare of the chord *B*C. as in the 47. of the firſt of Euclide.

And in the right lined triangles, the three ſides beeing giuen, the angles are alſo giuen, by the 44 45. &c. of the firſt of Regiomontanus, and by the 7. propoſition of the 13. chapter of Copernicus his firſt booke.

For example I take the former oberuation of the 16. of October. 1580. and worke as followeth.

The eleuation of the Pole CE. 51d. 32. the ſigne therof CH. 78297. The eleuation of the ſunne *B*D. 17. d. 0′. the ſigne thereof *B*K. 29237. The Arke *B*C. 102. d. 30′. the chord thereof *B*C. 155970. The complement of the eleuation of the ſunne *B*A. 73. d. 0′. the ſigne thereof *BM* 95630. the complement of the Latitude AC. 38. d. 28′. the ſigne thereof LC. 62205. equall to *M*N.

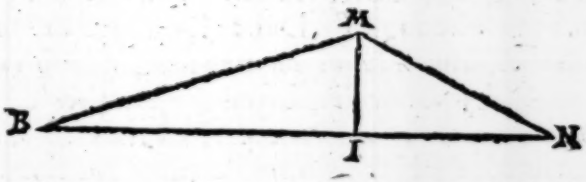
Now

Nowe out of CH.78297. ſubtract NH. equall to BK. 29237. Reſt NC. 59060.

Then out of the chord BC ſquared.——4432851257 6.
Take the ſquare of NC——————2406883600.

Reſt the ſquare of BN——————2192162897 6.
The root therof is 148059. the ſide BN.

So are the three ſides of the triangle giuen. { BN. 148059 / MN. 62205. / BM. 95630.



Now I finde the angle MI. ſubtract from the ſquare of *BM*. the bigger ſide, which is 9145096900. the ſquare of *M*N, the leſſer ſide, which is 3869462025. Reſt 5275634875, which deuided by the baſe *B*N. 148059. giueth 35631, the halfe thereof 56214 is IN. the leſſer caſe or ſhorter part of the baſe deuided by the perpendicular line MI, falling vpon the ſame from the obtuſe angle M. which ſubtracted from the whole baſe *B*N 148059 leaueth I*B* 91845, the greater caſe or longer part thereof.

Now it is manifeſt that theſe two caſes or parts of the baſe *B*I and IN are the ſignes of the twoo ſharpe angles I*MB*. and N*M*I made of the obtuſe angle *M* by the perpendicular falling from the ſame angle to the baſe, and the arkes of them ioined together, are the quantity of the obtuſe angle N*MB*.

Therefore to reduce them to the numbers of the ſignes firſt for the greater caſe *B*I making *BM* the whole ſigne, ſay.

BM

BM.	BM.	BI.	BI.
If 95630.	giue 100000.	then shall 91845.	giue 96042.

The arke therof is 73.d.49.′.38.″. Againe for the lesser case, making *M*N. the whole signe, say.

*M*N.	*M*N.	IN.	IN.
If 62205.	giue 100000.	then 56214.	giueth 90376.

Whose arke is 64.d.38.′.45.″. And adding these two arks together, they giue 138.d.28.′.23.″. the ark or quantity of the obtuse angle NMB equall to the spherical angle BAC and deducting it from the Semicirele 180.d. there resteth 41.d.31.′.37.″. the angle FAD the Horizontal distance of the Sunnes Azimuth from the meridian, and subtracting that from 52.d.35. the variatiō found vpon the instrumēt from north to west in the forenoone, resteth 11.d.3.′.23.″ the variation of the Needle from the meridian, the thinge that was proposed to be found. And comparing the same with the afternoons obseruation, you shal find it 11.d.31.′37.″. the cause of this difference I haue declared in the former chapter.

If the Reader bee delighted with varietie of demonstration of this matter, let him peruse the 34 Proposition of the 4. of Regiomontanus, and the 13. Proposition of the 14. Chapter of the first booke of Copernicus.

But whereas you see this calculation to differ from the former in some odde secondes, the reason thereof is not as it might be taken the different nature of the rules, but in working thereof, omitting the fractions in the deuisions, and neglecting the proportionall partes of the signes and arkes.

In these examples I haue vsed the abridged Table of 100000. the whole signe, which though it giue some ease in the working, yet it is not so exact as that of 10000000. of Erasmus Reinholdus. Vnto the which, with his Canon fœcundus answerable to the same, if the third canon of the

Hypo-

Hypothenuſaes were annexed, wee ſhould haue an entire Table for the doctrine of triangles, that might worthilye be called the table of tables. Which thing though Georgicus Ioachimus Rheticus, haue wel begunne and framed it orderly from ten minutes to ten: yet is it left very rawly, for ſuch as deſire the exact truth of things. I haue therefore for mine owne eaſe and vſe, calculated the complement of this Table, and almoſt ended, if for the whole quadrant from minute to minute: which if in the meane time before I haue finiſhed, I ſhall not finde it extant by anie other, I I wil publiſh it for the commoditie of al ſuch as ſhall haue occaſion to vſe the ſame for Nauigation and Coſmographie.

To find the eleuation of the pole, ſcituation of the Meridian, and variation of the Needle, at any place by the ſun, vpon two obſeruations, either in forenoone or afternoone.

The ſeuenth Chapter.

WHereas in the three laſte Chapters, the groundes of the calculations conſiſt in the Eleuation of the Pole to bee giuen, which thing to know is no leſſe difficult, then the chiefe matter that is by them required: for the common preceptes, which as yet haue chiefly bèen giuen for the finding therof, depend only vpon the obſeruation of the Meridian altitude of the Sunne or ſtarres, or elſe vpon certaine falſe and groſſe rules of the guardes and pole ſtarre. Therefore I haue thought good that as I haue ſhewed the way to knowe the variation, vppon any one obſeruation, either in forenoone or afternoone, the latitude of the place preſuppoſed: So likewiſe vpon two obſeruations by the ſunne, either in forenoone or afternoone, to ſet downe the way and manner howe to

finde the elevation of the Pole, scituation of the Meridian, and the variation of the Needle in anie place by the Globe.

But this you must alwaies regard, that your two observations may haue conuenient distance of time betweene them, the greater the better: So as the higher elevation be not taken neere the Meridian, the lower elevation, the neerer it is taken to the Azimuth of East or West, or to the Horizon the better, with which elevations you are to note the difference of the Sunnes Azimuths or Variations founde by the shadowe vppon the Instrument exactlye, for without that the elevations onelie are in vaine.

First it is requisite that your Globe be so fitted, that the meridian circle and the Horizon do crosse each other at right angles, and deuide themselues equallie into Semicircles. And also that the Quadrant of altitude (or moueable verticall) be placed dulie vpon the Meridian circle at the Zenith, so as beeing turned circularlie, it may touch the Horizon equallie in euerie part. These things beeing dulie considered, there needeth not anie further regard to be had for placing of the Globe, onelie this you may respect in setting the Pole at aduentures aboue the Horizon, betweene it and the Zenith, that the meridian circle may cut the Horizon in iust degrees, so may your Quadrant of altitude be placed in your Zenith iustly vpon a degree also.

Then must you fasten your Globe to the Horizon, so as it may remaine immoueable, but in fastning the same you must regarde that you force it not from one side of the Horizon to another, but that it rest equidistãt in the same, and hauing your Globe thus disposed, it is ready for you to applie your obseruations vppon, which you shall thus doe.

First, take your highest elevation, and note it vpon your Quadrant of altitude, and place the ende of the said Quadrant vpon the Horizon at 10. 15. or 20. &c. from the Meri-

dian

diam circle (but the neerer you set the same to the meridian, the more conueniently, without impeachment will your triall bee made.) Then giue a pricke vppon the Globe in the azimuth, that the Quadrant sheweth at the degree of the eleuation noted vppon the Quadrant, then againe note the lesser eleuation vpon the Quadrant of altitude, and remooue the same vpon the Horizon, (from that place wher it was first fixed, towards the azimuth of East or West (which shalbe neerest the same) so many degrees as you finde the differences of azimuths betweene the twoo eleuations by the shadowe of the sunne, vppon the instrument of Variation, and staying your quadrant of altitude vpon that point of the Horizon: note also your lesser eleuation in the same azimuth vppon your Globe. Thus doon, you must haue a pair of Talliper Compasses, such as may conueniently reach to 113.d.½ of the Equinoctiall of your Globe, (which is a Quadrant, and the greatest declination of the Sun) then you must cõsider which of the Poles of the world is eleuated aboue your Horizon, and whether your declination be towards, or from that Pole, that is to say, whether the Sun be betweene the eleuated Pole, and the Equinoctiall, or the Equinoctiall betweene the sunne & the Pole. If the sun be betweene the Pole and the Equinoctiall, then are you to detract the declination from 90.d. If the Equinoctiall be betweene the sun and the Pole, you must adde the declination to 90.d. And take the same remaining or collected number of degrees &c. with your compasses vpon the Equinoctiall. And set the one end of your compas at the pricke made vpon your Globe, for the highest obseruation, and with the other end discribe an arke or pæce of a circle, vppon the same side of the meridian that your prick is on, from the meridian to the Horizon. Then againe with your compas vnaltered, setting the one foot in the prick for the lowest obseruation, describe an other pæce of a like circle crossing ỳ former: the point of the intersection, or crossing of these 2. circles, is the eleuated pole, to the

which if you remoouethe Quadrant of altitude, you shall find what the eleuation thereof is. And the point that the same Quadrant sheweth vpon the Horizon, is the intersection of the Meridian and the Horizon, the Horizontall distaunce betweene this intersection, and the azimuth of the lesser obseruation, subtracted from the Semicircle, or 180.d leaueth the Horizontall distaunce of the same azimuth from the true meridian. So haue you the eleuation of the Pole, and scituation of the meridian.

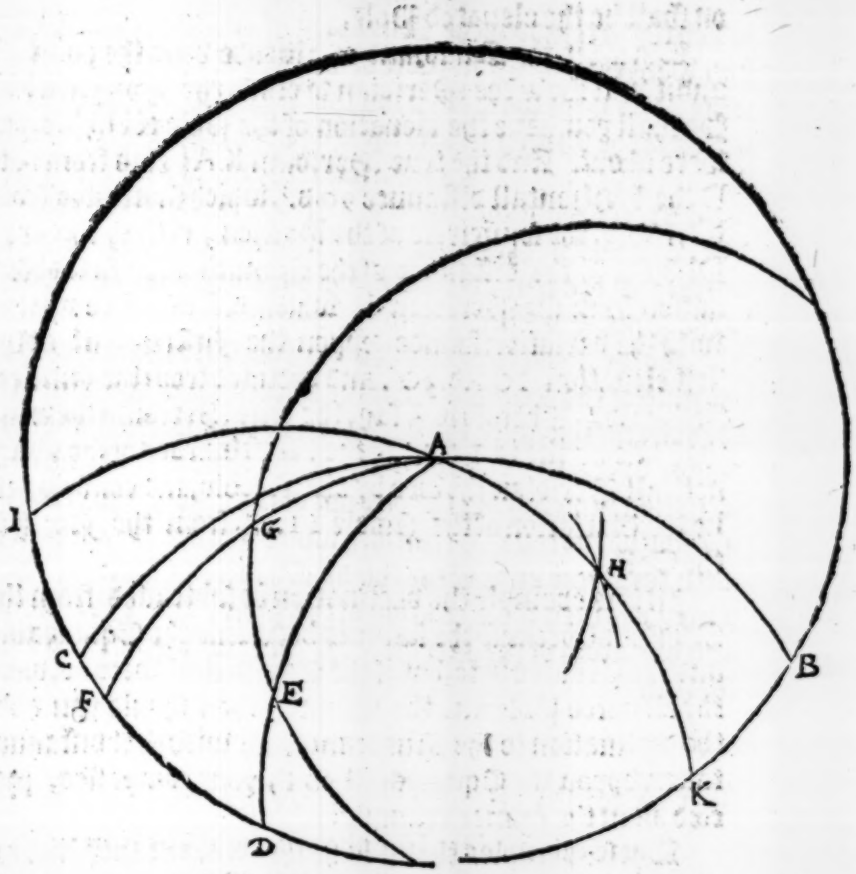
Nowe if you compare the Horizontall distance of the azimuth of the Sunne, from the Meridian at the time of the obseruation, with the variation by the sunnes shadowe founde vppon the Instrument, at the time of the same obseruation, and taking the one out of the other, the remainer shalbe the true variation, which you are to account, as in the latter ende of the thirde Chapter is shewed. So haue you giuen the eleuation of the Pole, the Meridian, and variation of the Needle, the thinges propoſed to bee shewed.

EXAMPLE OF TWO OBSERuations made at Limehouſe, the 29. of Iulie 1581. in the forenoone.

The first eleuation 21.d.0′. Variation 100.d.30′. from North to West. The second eleuation 50.d.0′. Variation 48 d.0′. from North to West. Difference of the Azimuth 52.d.30′. The Declination 16.d.14′. Northerlie.

LEt IDB. be the Horizon of the Globe. CAB. the Meridian circle. FGA. the Azimuth of the greater eleuation shewed by the Quadrant of altitude vpon the Horizon at F. 10.d. from the meridian circle of the globe C. FG the greater eleuation marked vppon the Globe at G. FD

the



the difference of the Azimuth vpon the Horizon. 52. d. 30'. E. the pricke of the lesser eleuation marked vpon the Globe in the Azimuth AED.

Then opening your Compasses to 73. d. 46'. of the Equinoctiall (which is the complement of the declination) and setting one end vpon G. the point of the greater eleuation, describe with the other ende, an arke or peece of a circle at H.

This doone, set one foot of the Compas vnaltered in E. the lesser eleuation, and with the other end describe a peece of a circle crossing the former arke at H. this intersecti-

on shall be the eleuated Pole.

Then set the Quadrant of altitude vnto the point H. and it will shew the Meridian to crosse the Horizon at K. So shall you haue the eleuation of the Pole KH. 51.d.½. or there about. And the true Meridian KAI And from K to D the Horizontall distaunce 90.d.¹. which subtracted from KI. 180.d. the semicircle of the Horizon, resteth the arke DI. 89.d. ¼. the distaunce of the Azimuth of the first obseruation from the Meridian I. which distaunce compared with the variation founde vppon the Instrument at the first eleuation 100.d.30′. and deducted from the same resteth 11.d.¼. Therefore I say, the true Meridian shewing the Pole artike is 11.d.¼ to the Westwardes of the Magneticall Meridian shewed by the Needle, and consequentlie the Variation of the Needle 11.d.¼. from the North to the East.

In this example the declination is subtracted from the Quadrant, because the sunne is betweene the Equinoctiall and the eleuated pole, but if the Equinoctial were betwéen the eleuated Pole and the Sunne, then should you adde the declination to the Quadrant, and with that distaunce taken vppon the Equinoctiall with your compasses, procéd as in the former example.

These examples that I haue shewed, and such like experimentes to bee doone vppon the Globe, are easie to bee conceiued, and the reasons verie manifest: but the truth of the matter consisteth in the exactnesse of the instrumentes, and the orderlie application and handling of them.

I might heere haue annexed the manner, how vppon two obseruations of the Sunnes eleuation in forenoone or afternoone, and difference of the Azimuthes, to calculate the Premises more exactlye by the Table of Signes and doctrine of spericall Triangles: but that it is a verye tedious waie, and my meaning is rather to giue the Reader a proofe of the pleasaunt vse of these calculations

(which

(which I thinke I haue sufficiently doone in the former Chapters) then to cloie him at the first with the hard and painfull practise of manie examples. Notwithstanding, for the satisfaction of some, I will briefly set down the ground and summe of the worke, which is this.

The Complements of your two eleuations, are two sides of a spherical triangle not rectangle. The angle by these two knowne sides contained at the Zenith, is giuen by the difference of the Azimuthes or Variations vppon the instrument. Wherefore by the 28. of the 4. of Regiomontanus the third side (which is the arke comprehended betweene the two eleuations) and the other angles maie be giuen.

Then haue you another like triangle, whose three sides are these: the first, one of the foresaid complemẽts of eleuation: the second, the arke of the circle of declination, betweene the Sun at the instant of the same eleuation, and the Eleuated Pole. The third side is an arke of the Meridian betweene the Zenith and the Pole: which is the complement of the eleuation of the Pole, or latitude of the place.

The two first sides are alwaies giuen. For finding the third side, it is necessarie to knowe the angle that the two giuen sides containe, which is the difference of two angles, whereof one is an angle of the first Triangle giuen, the other an angle contained betweene the arke of the circle of declination, and the third side of the first Triangle, which angle is diuersely found, and beeing founde and substracted from the other angle, or that from it, the difference is the Angle of this other Tryangle: And so haue you in the Spherical Triangle two sides, and the angle by the same two sides contained giuen. And by the same 28. of the fourth of Regiomontanus the third side is founde, the complement whereof is the eleuation of the Pole.

And the eleuation of the Pole, and declination of the

Sun being giuen, the fourth Chapter sheweth by one obseruation, to finde the variation of the Needle.

Of the Pole of the Magnes.

The eight Chapter.

DIuers learned men haue iudged, and set down as a truth (grounded vpon reporte) that the meridian common to the Pole of the world, & the Pole of the Magnes (that is to say, where the Needle touched with the Magnes, sheweth the Pole of ỹ world directly) passeth at the Ilands of the Acores, or neere there about, (but I find by great probabillity, that it should be to the West wards of those Ilands.) From which meridian at the Acores, I account the beginning of Longitudes, and find our Meridian of London, to be from the same, 23.d.½ our Latitude as before said. 51.d.32′. and the variation of the Compas or Needle. 11.d.¼ from the North to the east-wards. Now vpon these grounds I finde by calculation, the Pole of the Magnes, or the intersectiõ of the two Magneticall meridians, vpon the superficies of the earth, to bee from the Pole artik 25.d.44′. & in longitude 180.d. that is to say, 25.d.44′. in the former common meridian, on the other side of the Pole.

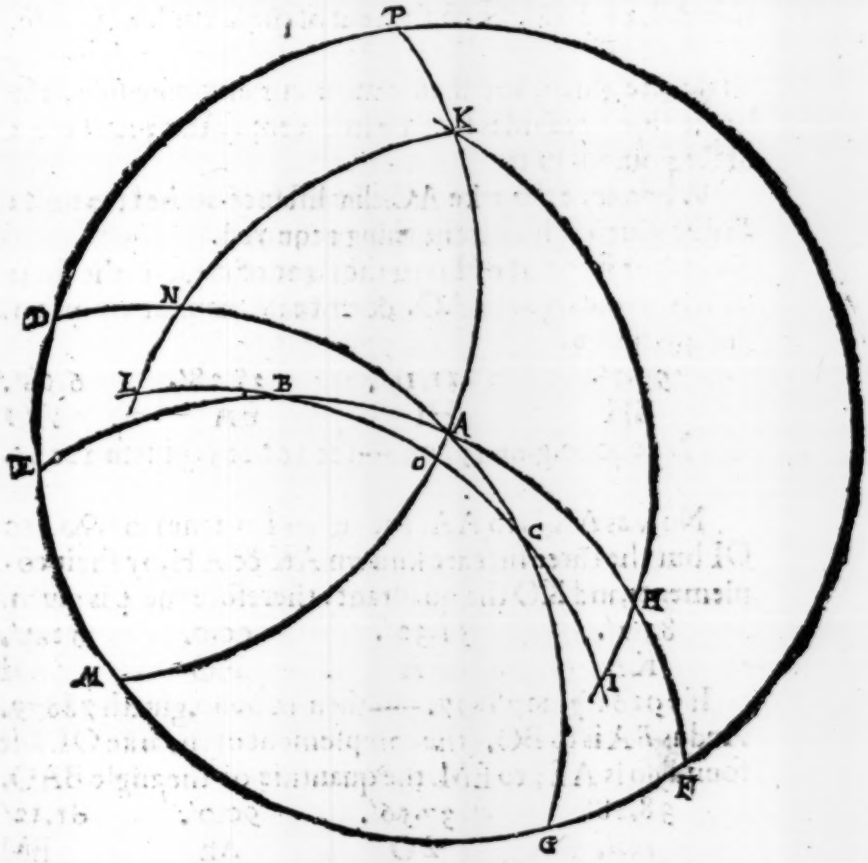
It may bee happilie that some of you will be desirous to know the way how this Magneticall Pole is found out, that you may applie the same to like purpose heereafter. Therefore I thought good to set downe the manner of the former calculation, by helpe of the declinations in the figure following.

Example.

LEt A. be the Pole Artike. *P*EF. the Equinoctial. DAG. the common Meridian of the Pole Artik, and Pole of the

the *Magnes* EAF the meridian for London.

LOI the *Magneticall* meridian of London, $\mathcal{B}_o$ for the place of London. HI the quantitie of the angle of Variation at the ende of the quadrants BH and BI. C the inter-



fection of the two magnetical meridians CL and CN two Quadrants of the ſaide *Magneticall* circles, including the arke LN the quantity of the angle at C. *PAM* the Semicircle of a Meridian croſsing the *Magneticall Meridian* of *London* in the point O. at right angles.

Make out the quadrants IHK and LNK ſo ſhall they croſſe themſelues with the quadrant OAK at the point *K*

Now

Now haue you ABC a ſpherical triangle, two angles whereof, and the common containing ſide of them, are giuen ABC. 11. d. ½. the angle of variation at London, BAC. 156. d. 30′. the complement of the angle DAE (the difference of the longitudes) to 2 right angles. And the ſide AB. 38. d. 28′. the cõplement of the latitude of Londõ.

And in a ſpherical triangle, not rectangle, whoſe two angles are giuen, and their common containing ſide, the other angle and ſides ſhall be knowen, by the 31. of the 4 of Regiomontanus.

Wherefore the arke AC. the diſtance of the two poles ſhalbe giuen, which is the thing required.

For as the ſigne of BH is to the ſigne of HI, ſo is the ſigne of *B*A. to the ſigne of AO. & three of them being giuen, the 4. is found.

90.0′.	11.15′.	38.28′.	6.58′.
BH	HI	BA	AO

If 100000. giue 19509. —then 62205. giueth 12135.

Now as AK is to AA (the ſignes I meane) ſo is KO to OI. but the three firſt are known AK & AH, by their cõplements, and KO the quadrant: therefore the 4 is giuen.

83.2′.	51.32′.	90.0.	52.4′.
KA	HA	KO	OI

If 99261, giue 78297. —then 100000, giueth 78879.

And as *B*A is to BO. (the complement of the arke OI. laſt found) ſo is AE, to EM. the quantitie of the angle BAO.

38.28′.	37.56′.	90.0′.	81.12′
A*B*.	*B*O	AE	EM

If 62205. giue 61474. —then 100000. giueth 98824

So hauing *EM*. 18. d. 12′. the quantitie of the angle BAO I ſubſtracte the ſame from EG. 156. d. 30′. the quantitie of the whole angle *B*AC. reſt MG. 75. d. 18′. the quantitie of the angle CAO, to the which is equall the oppoſite angle PAD. And as AP. is to P*D*. ſo is AK to KN.

90.0′.	75.18′.	83.2′.	73.46.
AP	PD	AK	KN

If 100000. giue 96726. —— then 99261, giueth 96011′.

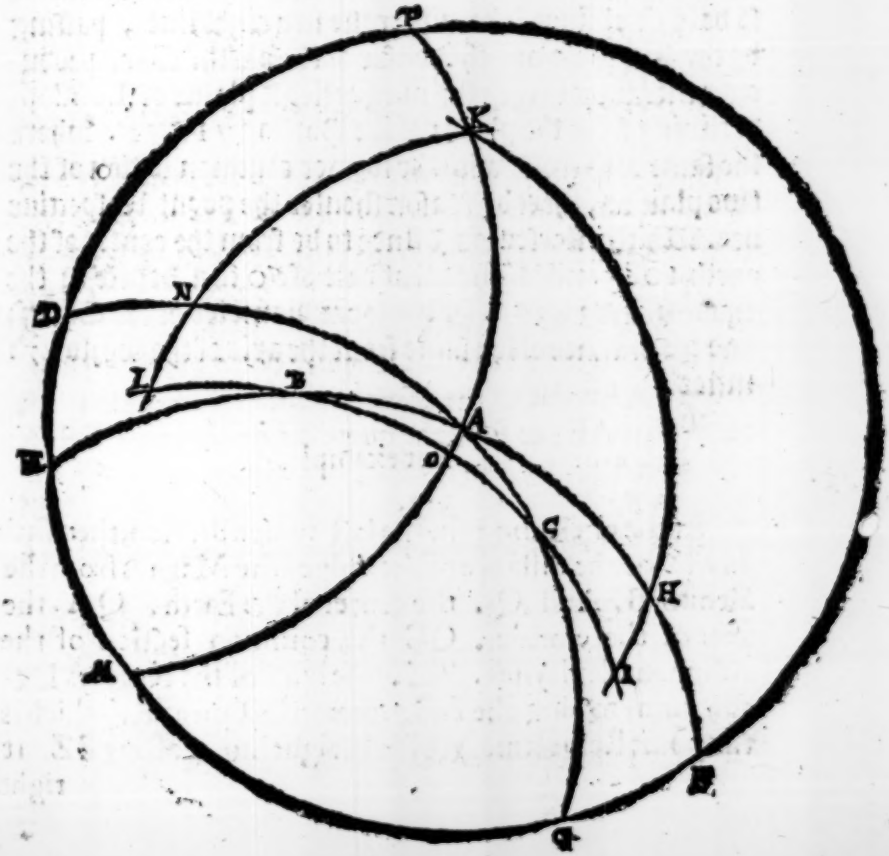
The complement of which arke KN is NL. 16.d.14′. the quantitie of the angle ABC. And as NL. is to NC, so is AO to AC. Wherefore I say.

16.14′.	65.8′.	25.44′.	
NL	NC	AO	AC.

If 27954. giue 100000. —— then 12135. giueth 43410.

Which is the distance of the pole of the Magnes from the Pole artike vpon the former Hipothesis, the thing that was sought.

Of



Of the point Respectiue.

The ninth Chapter.

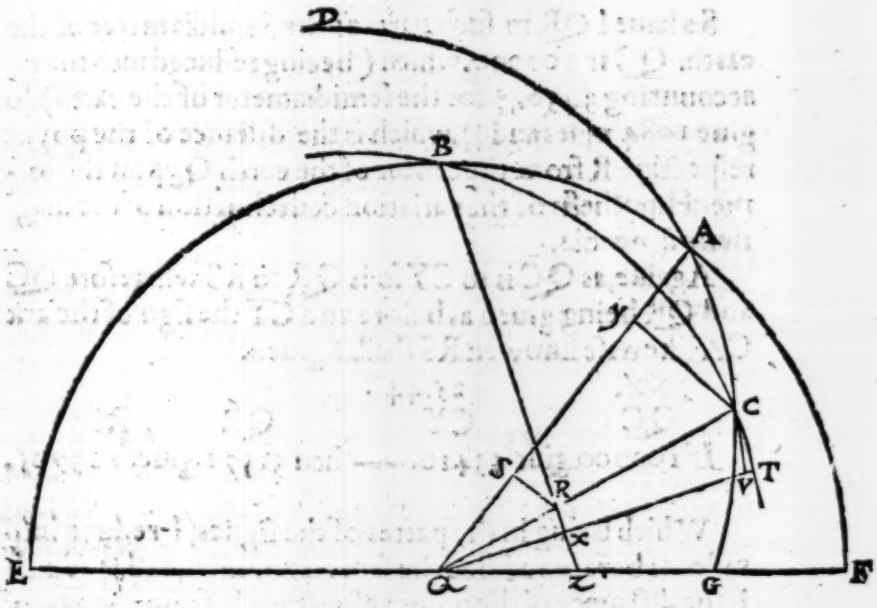
HAuing shewed in the former Chapter, vpon the groundes therein specified, the place of the Pole of the Magnes vpon the superficies of the earth: there resteth now to be declared of the point respectiue, wher it should be, by the new propertie found of the declining of the Needle, beeing at this place for London, 71.d.50′. as in the former treatise by R. Norman.

First it is to be considered, that as the Magnetical meridians do crosse themselues at their pole before specified: so do their plaines likewise crosse in a right line, passing by the said Pole, and the center of the earth. Then producing a straight line in the magneticall plaine of London, declining from the plaine of the Horizon 71.d.51′. where the same doth crosse with the former common section of the two plaines, thereby reason shoulde the poynt Respectiue bee. Which intersection I finde to be from the center of the earth 1085. miles (after that rate of 60 to a degree in the equator, and 3436$\frac{4}{11}$. for the Semidiameter of the Earth) and the distance of the same from the axis of the world 471 miles.

For example.

LEt the circles be as in the last demonstration, then shal BC. be the distance of the pole of the Magnes from the Zenith B. And Q. the center of the Earth. QA. the axis of the worlde. QC the common section of the Magneticall playnes. BZ. the lyne of the Needles Declination crosing the said common section at R. (which is the point Respectiue.) QT a straight line crosing BZ. at

right



right angles in X, QR. the diſtance of the point Reſpec-time from the center of the earth, RS. the diſtance there-of from the axis. Firſt it is requiſite to knowe the quantity of the arke BC, which is thus found, as the ſigne of the angle A*B*C 11.d, 15′. hath vnto the ſigne of the arke AC, 25 d. 44′. So hath the ſigne of the angle BAC, 156, d, 30. (which is al one with the ſigne of the angle *B*AD, the difference of Longitude 23, d. 30′.) to the ſigne of the ark *B*C which is 62. d, 46′. Now as QV is to QC ſo is QX to QR. But the three firſt are knowen QV, the ſecond right ſigne of the arke CT 9, d. 4′. (the difference of the Arke BT, 71, d, 50′. And *B*C 62. d. 46,) Then QC the Semidiameter or whole ſigne, and QX, the ſecond right ſigne of the arke *B*T. Wherefore QR ſhall be giuen by the 4, of the ſixt of Euclide.

80. 56′.	90, 0′.	18. 10′.	
QV	QC	QX	QR

If 98.750 giue 100000——then 31178. giueth 31572.

So haue I QR in such parts as the Semidiameter of the earth. QC is 100000. which (beeing reduced into miles, accounting 3436. $\frac{4}{11}$. for the semidiameter of the earth) do giue 1084 miles and $\frac{14}{11}$. which is the distance of the poynt respectiue R from the center of the earth Q vpon the former Hipothesis of the variation & declination of the magneticall needle,

Againe, as QC is to CY so is QR to RS wherefore QC and QR being giuen as before, and CY the sign of the ark CA likewise knowen RS shalbe giuen.

90.0′.	25.44′.		
QC	CY	QR	RS

If 100000. giue 43410.——then 31572. giueth 13705.

Which being in the partes of the signes, I reduce into miles as before and find the same 470. miles, and $\frac{11}{11}$. which is the distaunce of the point respectiue R from the axis of the world QA. By the former Hypothesis,

The tenth Chapter.

Of the application of the variation, to the vse of Nauigation.

Vpon the Hipothesis of ỹ pole of the Magnes on the superficies of the earth, and the point Respective in the bodye thereof, according to the former calculations, might bee inferred many pleasaunt conclusions, both for the longitude & latitude of places.

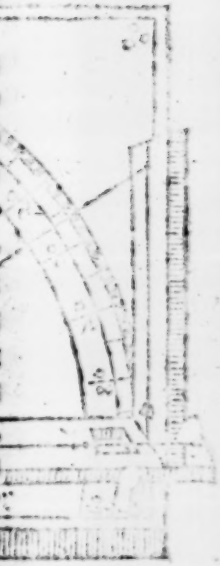
But as touching the point Respective by the declining of the Needle, seeing this is the first and onely experiment that hath beene made of it, I cannot inferre any further matter thereof, than that which I haue already set down, vntill by obseruations in other places, wee finde howe it will holde.

And

And as for the variation, if it were generally regular and certaine, as in some parte it seemeth to be: (that is to saie, from hence Westwardes to Meta Incognita, Newe-found-land, Florida, and that part of the coast of America) then might there beginen by it generall rules, commodious for the vse of Nauigation.

And by the same Hypothesis of the Pole of the magnes at 25.44′. from the Pole of the worlde, the greatest variation of the Needle in the Equinoctiall, should be (at 90.d. of Longitude) 25.44′. from North to East, and consequently the greatest variation in the Paralell of 70 d. should be (at the Longitude of 128.d.51′.) from North to East 81.d.14′. And in the meridian of 180.d. of longitude betweene the two Poles (the Pole artick I meane) & the supposed Pole of the Magnes, there should the North point of the needle or compasse respecting his own pole, shew the south, and the south point the North pole of the world.

But in my trauailes to the North east partes, I haue found this position of the Magneticall Pole cleane reuersed: for where as the angle of Variation from hence Eastwardes in the Paralell of 70.d. should encrease and grow wider, till it came to 81.d.14′. from North to East as before. At the Iland Vaigats being in longitude from London. 58.d. and in the same Paralell of 70.d. where, by the former Hypothesis, the variation should be 49.d.22′. from North to East. I finde the Needle to varie 7. degrees from North to West. And the like effect I haue found by diuers obseruations in sundry other places of the East partes. Which obseruations with many more that I haue caused to be made, and dayly procure to be done in diuers other Countries, I reserue, with intent (if it be possible) to finde some Hypothesis for the saluing of this apparant confused irregularitie.

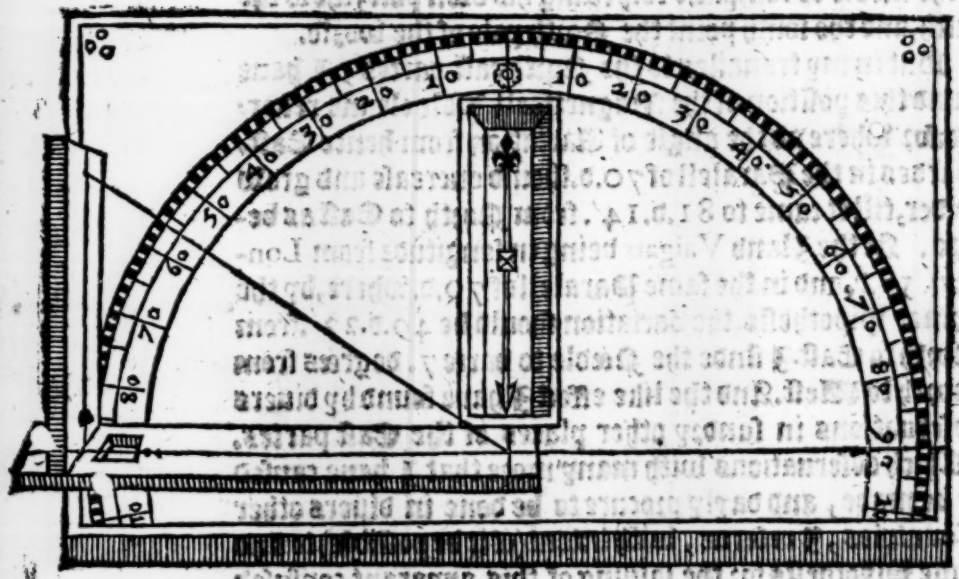


At Ratisbona or Regensburg in Bauaria, being in latitude 48.d.52′. & in longitude 36.d.20′. where, by the former position of the Magneticall Pole at 25.d.44′. the varia-

Variation should be 16.d.44′. from North to East. Gerardus Mercator found the same to be onelie 11.¼ as I gather by his placing of the Magneticall Pole at 16.d.22′. from the Pole artike, vppon his obseruation made at that place: which confirmeth the retrograde qualitie in the variation from hence Eastwards, as afore said.

Which strange varietie, I haue heere plainly proposed, to the end that the learned sort might consider therof, and sharpning their wits, see what probable causes & grounds they can assigne for the same. For considering it remayneth alwaies constant without alteratiō in euery seuerall place, there is hope it may be reduced into method & rule.

A new Instrument for the Variation.



BEcause I haue founde some imperfections in the first instrument for the variation (which notwithstanding doth far exceed the compasses of variation heeretofore vsed for that purpose) I haue heere set down the forme of a new

Instrument

Instrument wherein all scruple of doubts and defects that might growe by other is quite auoyded. Which beeing once exactlie placed with the needle vpon the line of south and north, will serue without remouing for a whole dates obseruation, the Inder onely beeing carried about wyth the Sunne, to giue the degrées of Azimuth vpon the Instrument by the shadowe of the line thereof, and is otherwise to bee vsed according to the prescript rules of the former Instrument.

Of the inconueniences and defectes in sayling, and in description of Countries, caused by the variation of the Compasse.

The eleuenth Chapter.

IN all Sea Chartes generally, which are made without consideration of the variation, are committed great errors and confusion. For, either the partes therein contayned, are framed to agree in their latitudes by the skale thereof, & wrested from the true courses that one place beareth from another by the Compasse, or else in setting the partes to agree in their due courses, they haue placed them in false latitudes, or abridged, or ouerstretched the true distaunces betweene them.

In the Marine Plats made for Newfoundland, the course set downe from Sillie to Cape Raso is due West, which is found to be so for our common sayling Compasse, whose wiers are set ½. a point from North to East, notwithstanding Sillie being in latitude 50. d. lyttle more. Cape Raso in Newfoundland is found to bee but in 46. d. ⅔ which is 3. d. ⅓ lesse then the latitude of Sillie.

To make a shew of reformation of this error, caused by the variation and setting of the wiers in the (Compasse) or to giue a light of that difference in longitude, they

haue placed in the plat againſte that coaſt a newe ſkale of Latitude, ſome vppon the line of South and North, and ſome other haue placed the ſame vppon the line of North Northeaſt, and South Southweſt (becauſe the point of the Compaſſe ſheweth the Pole nereſt in that place) and haue furniſhed the degrees thereof agreeable to the Latytude of Cape Raſo: and by that meanes haue had a double ſcale of latitude, one for the Eaſter coaſts, the other for that Weſt. But how farre the ſame hath beene from reforming the errour, or giuing any helpe to Nauigation, you may eaſily iudge.

Others, to auoyde that errour of the difference in Latitude in that voyage and courſe, haue vſed Compaſſes, whoſe wiers haue beene ſette dyrectly vnder the North poynt, and thereby ſayling Weſt from Sillie, haue fallen to the Northwardes of Cape Raſo about 50. leagues, and in latitude neere 49. d.

Some other haue vſed in the ſame voyage to place a blanke Flie vpon their ſayling compaſſe, which they haue remoued from time to time, as they haue iudged the variation hath altered: by which way, albeit they may ſeeme to keepe themſelues nearer the paralell, yet the ſame in Nauigation worketh the greateſt confuſion of all other, & therefore is to be vtterly aboliſhed.

In our voyages from hence Eaſtwards to S. Nicholas in Ruſſia, and to the Narue in Liuonia &c. The Marine Plats of the coaſtes are deſcribed by our Common ſailing Compaſſe, with conſideration of the variations at dyuers places, whereby the true meridians reformedly ſet down, declyning from the paralell Meridians of the plat, doe neceſſarie widen Northwardes, and ſtraighten to the Southwardes, contrarie to the true forme and nature of meridians. And yet notwithſtanding, that is the beſt meanes hitherto knowen, to reforme in Plat, the errours that elſe would growe by the ſtraunge variations that way.

And

And albeit these places serue veris well for those Nauigations, yet by meanes of the variations considered, the forme of those coastes is so disto3ted from the ryght shape it shoulde beare, beeing truely described vppon the globe o3 otherwise in plaine, acco3ding to the true latitude and longitude: That whereas the Narue (beeing in Latitude 59.d.½. and in Longitude from the Meridian of London 26.d.10′.) should be from S. Nicholas 9.d.40′. in lõgitude to the West wardes (S. Nicholas beeing in Latitude 64.d.35′. and in longitude from London 35.d.50′.) In the sailing Plat it is brought to bee in the meridian of Colmogorõd, (which is in latitude 94.d.20′. and in longitude from London 37.d.45′.) which is 1.d 55. to the eastwards of the meridian of S. Nicholas.

Into the Mediterranean Sea, and in the coastes thereof, wherein great reason should be the perfectest descriptions of the worlde, for that in those partes haue bene the seates and abodes of the most famous and learned men in all ages, we see notwithstanding in the marine Plats of those partes, grosse errours commited, through want of knowledge of the variation, and the vse thereof, in which they haue not accounted of 3.4.o3 5. degrees errour in the latitude of places.

But those defects of the latitudes haue bene very well reformed, by the famous and learned Gerardus Mercator (whom I honor and esteeme as the chiefe Colmographer of this time) in his vniuersall Map, which though hee haue made with sailing lines, & dedicated to the vse of Seamẽ, yet for want of consideration of the variation, the same is more fit for such to beholde, as study in Colmographie, by reading authors vppon the lande, then to be vsed in Nauigation at the sea.

There is also in the same vniuersall Mappe, and likewise in all other moderne Maps of the North parts of Europe, a great fault, by placing two Wardhouses distaunt one from the other aboue 20 d. in longitude, whereas

indeede they are but one thing, and no such distaunce betweene them. This error hath growen by taking Wardhouse, and the Sea costes, from thence to S. Nicolas Vaigats, and the Ob &c. out of the Map of of that worthy trauailer, M. Anthonie Ienkinsons his iourney to Boghar & Persia, &c. In the which I placed that border of the Sea coast, and for some causes went no further Westwardes in that description, then Wardhouse which is in latitude 70. d. ; and in longitude from London 29. d. Wherefore to accomplish the whole border of that coast, hee was forced to seeke some other description to ioyne with it, and toke as appeareth the Map of Olaus Magnus of the north Countries, wherein he found likewise Wardhouse, but falsely placed in latitude about 19. d. too much, & in longitude as much too little, the which, although he might take to be the same specified in Maister Ienkinsons Map, yet he was constrained to seperate them the said distaunce of 20. d. in longitude (or to leaue there so much superfluous rome) otherwise he should haue thrust the South partes of those Countries togeather, and confounded the whole description.

And albeit he had had the entire sailing Plat, that wee vse for those parts, yet if hee had not knowen the secret effect of the Variation in the making thereof, he might haue fallen into the like absurditie or worse. But of those coasts and of the inward partes of the Countries, Russia, Muscouia, &c. I haue made a perfect Plat and description, by mine owne experience in sundrie voyages and trauailes, both by Sea and Land, too and fro in those parts, which I gaue to her Maiestie in Anno 1578.

Besides these and like imperfections proceeding of the Variation, there is yet another inconuenience, which oftentimes encreaseth the former errours, and that is, the diuers placing of the wiers, fixed to the Flie of the Compas.

This varietie of setting the wiers, hath caused great confu-

confusion in Nauigation, and in other accountes of Sea causes: for when it is said, that from such a head land, to such a place, in such a course, or at such a place the Wynde vpon suche a point of the Compasse maketh the full Sea, it is requisit to bee demaunded, by what Compasse the obseruation was made, whereas if the wiers had not bene altered from the North poynt of the Flie, which I wishe had neuer bene any where) these doubtes had beene auoyded.

It behoueth therefore all men that will make Hydrographicall descriptions for the vse of sailing, to haue speciall regarde of the Compasse by which these obseruations are made, and if they collecte notes made by sundry Compasses of diuerse settes, they ought to reduce all the varieties vnto some one certaine, and to giue notice of the same in their Plat: And not to make a confused mingle mangle by ioyning togeather all varieties of obseruations, notes, and reports, as the Portingales and Spaniards haue done, in compounding these North partes of the worlde, with their owne discoueries, without consideration of the diuers sortes of the seueral compasses by which they were made.

Also it importeth all maisters, Pilots, and others by what name soeuer, that shall giue directions in Nauigation, to looke circumspectly to the setting of the wiers of the Compasse by which they shall sayle, that the same Compasse be correspondent, to the lines of the Sea Carde that they shall vse: that is to say, that it be of the same set for the variation, that the Compasse was of, by which the carde was made.

And seeing we haue in this our countrey, acquainted our selues commonly in our obseruations and Nauygations, with the Compasse, whose wiers are set at ½. a point from North to East, I meane in the descriptions that I shall make to applie the same agreeable to the said Compasse and would vse the like without alteration (and al-

to the straight lines in Sea Cards) if I should saile round about the worlde to make the description thereof, but alway with regarde of the seueral variations of euery place, where the same should be obserued.

Of the Instruments and rules in Nauigation.

The Twelfe Chapter.

Amongst the rules and Instrumentes for Nauigation, all such are vaine & to small purpose, wherin the true meridian is presupposed to begiuen by the Magneticall Needle, without due consideration of the Variation, for that they are all grounded vpon false suppositions. Hereby it commeth to passe that one Michael Coignet of Antwerp, in his New instruction (as hee tearmeth it) of the most excellent and necessarye points of Nauigation, wherin he sheweth the making and vse of a Nauticall Hemisphere, which he preferreth before all other Sea Instruments, is very childishly abused. For whereas he pretendeth by it, to giue the eleuation of the Pole, and the houre and instant of the time of the daie, by any one obseruation in any place: besides that, it is of all other that hath hetherto beene vsed at Sea, the moste tedious and vnfit for that purpose: it is also by reason of the variation not considered, meere false and erroneous. For the true Meridian (which is the grounde of hys purpose, as farre to seeke as the thinge hee promiseth by to giue by the same. The like may bee sayd of all other instrumentes made vppon the same grounde, whether they serue for the sea or land.

The same author in the 4. Chapter of his booke, entreating of sailing vpon the pointes of the Compasse, sayth, that in sayling South or North he shall passe by the poles

of

of the world, and keepe vnder one Meridian, till hee come to the place from whence he first departed. And vpon the points of East and West out of the Equinoctiall, hee shall saile vnder a Paralell, till hee returne to the place from whence he went. But in sailing vpon the point of North-East, he shall describe a spirall line inclining by little and little towards the Pole, as in his demonstration thereof in the same Chapter appeareth. But for want of due consideration of the variation, his rules, reasons, and demonstrations, and such others hitherto giuen for like purposes are friuolous and false.

For if he direct his sailing by the Compasse (as of necessitie he must, beeing the onelie Instrument for that purpose) it is manifest, that whether hee saile North or south, East or West, or by what other point so euer, the Compasse not respecting alwaies the Pole of the World, as hee supposeth, but some other pointe or points distaunt from the same, shall lead him accordinglie, whereby hee shall neither keepe vnder one Meridian, nor vnder one paralell of latitude, neither make such a spirall line to the Pole of the worlde, as he demonstrateth. His fault in setting downe those rules is so much the greater, in that hee acknowledgeth in the Chapter next before the variation at Antwerpe, to be about 9. d. from North to East according to Mercators position, of the Magnetical Pole, which he also confirmeth by his owne experience.

But it seemeth he hath followed that excellent Mathematician Petrus Nonius, especially concerning the sailing vpon the points of East and West. For he, in his first booke of the rules and Instruments of Nauigation, endeuoreth himselfe to proue and demonstrate, that in sailing East or West out of the Equinoctiall, the course is performed by peeces of great circles, and yet describeth a paralell. But howe that maye stande with the principles of Geometrie, I referre the iudgement to the expert Mathematicians, for it is like as a circle shoulde bee

made of straight lines, which is impossible.

It appeareth in the discourse that hee hath made of these matters, that hee had not a right iudgement of the nature of the Compasse in sailing (admitting the same to shew the Pole without Variation) for if he had, he would neuer haue entered in such a Labyrinth as he did. But hee thought it a great absurditie that the Compasse in euerye Horizon, should shew the Meridian & Poles of the worlde by the points of North and South, and by the pointes of East and West, to shewe in the Horizon the verticall and Equinoctiall East and West, (beeing a great circle) and yet in sailing East or West, except in the Equinoctiall, it should performe but a paralell.

But it is to bee vnderstoode, that albeit the points or lines of the Compasse do alwaies in euery Horizon represent great circles in the Heauens, the pointes of South and North the Meridian, and the points of East and west the verticall circle of East and West, each crossing other at right angles, and likewise of the pointes. (The reason whereof is, because the Compasse lieth euery where leuel with the Horizon, so as a perpendicall line descendyng from the center thereof at right angles with the playne of the same, will alwaies fall vppon the center of the earth, and consequently bee the Semidiameter of a great circle) so that wheresoeuer the Compasse bee caried, these circles are supposed to bee carried about with it, and the viewe of euerie thing in the Horizon, represented by the poyntes thereof, is likewise in great circles: Yet in sailing by the Compasse, the points of South and North onely, describe great circles generallie, which are the Meridians, and the pointes of East and West, describe a great circle in the Equinoctiall onelie: in all other places out of the Equinoctiall, they describe but Paralels. And the sailing vpon anie other point of the Compasse from anye place, describeth a spirall line, according to the angle it maketh with the Meridian. And heereby in sailing vppon the

points

points of East or West, out of the Equinoctial,) the North point alwaies respecting the pole (the course performeth a Parallell, according to the distaunce of the center of the Compasse from the pole. The manner thereof you may perceiue by fastning a small thrid or Virginall wier at the Pole of a Globe, or center of a circle, which shall represent a moueable Meridian to be carried about the globe or circle, and fixe vpon the same, a small Flie of a Compasse, so as the line of South and North be answerable to the thrid or wier, and the North point thereby alwaies respect the North pole: then in turning the thrid about the Globe or circle, vpon the Pole or center, if the center of the Flie be out of the equinoctiall, (betweens it and the Pole) albeit the pointes of East and West, crossing the same line and moueable meridian at right angles, doe shewe the Verticall East and West vppon the Globe, which is a great circle, yet in carring the same Flie vpon the thrid or moueable meridian about the pole or center, you shall by the center of the same Flie describe but a Parallell according to the distaunce thereof from the Pole of the Globe, or center of the circle, not vnlike the circular motion of a horse drawing in a Mil, who though he loke forth straight in a right line, yet being fastned to the beame of the Mill, is forced to make his course in a circle, whose semidiameter is the length of the beam contained betweene the horse and the center of your mill or milpoll.

And as in the Equinoctiall, the line of South and North in the Compasse (by supposition representing the Meridian) is parallell to the Axis of the earth, (which is the common section of all the Meridian plaines,) and the line of East and West, crossing the same Axis of right angles, representeth the vertical East and West, which is the Equinoctiall, imagining to discend from the center of the Compasse a line, to fall perpendicularlie, and at right angles with the Axis of the worlde (which shalbee at the center of the earth) and in sailing East or West by the com-

passe

passe, the imagined perpendicular line being caried about with the same (making alwaies right angles with the axis) shall describe the plaine of the Equinoctiall, Equidistant from the Poles of the worlde, and at right angles with the axis: and the point of the same line at the center of the Compasse, the circumference of the Equinoctiall, vpon the superficies of the Sea: so beeing from the Equinoctiall on either side, imagining the line of south and North in your Compasse, to represent alwaies the Axis of the Worlde, and to lie Paralell with it, the line of East and West must crosse the same axis alwayes at right angles: And supposing a line to fall from the center of your Compasse to the axis of the worlde, making right angles with the same axis. In sayling East or West, that imagined line beeing carried about with the Compasse (alwaies at right angles with the axis) shall describe the plaine of a paralell, equidistant to the plaine of the Equinoctiall, and the point thereof at the center of the Compasse, the circumference of the paralell vpon the superficies of the sea: which Paralell should be represented by the points of East & West of the compasse, if the line of south and North of the same, were Paralell to the axis of the Poles, as was supposed, but it is not. And therefore, as they decline one from ỹ other, so doth the verticall circle of East and West shewed by the Compasse, decline from the paralell circle euerie where.

The angle of which declination is alwaies equall to the latitude of the place, or distaunce of the Paralell from the equinoctiall.

But as I haue already sufficiently declared, the compasse sheweth not alwaies the Pole of the worlde, but varieth from the same diuersely, and in sailing describeth circles accordingly. Which thing, if Petrus Nonius and the rest that haue written of Nauigation, had ioyntly considered in the tractation of their rules and Instrumentes, then might they haue beene more auaileable to the vse of

Naui-

Nauigation, but they perceiuing the difficultye of the thing, and that if they had dealt therewith, it would haue vtterlie ouer-whelmed their former plaucible conceites, with Pedro de Medina (who as it appeareth hauing some small suspition of the matter, reasoneth very clarkly, that it is not necessarie that such an absurditie as the Variation, should bee admytted in such an excellent art as Nauigation is) they haue all thought best to passe it ouer with silence. But I hope such as intend hereafter to write of Nauigation, will either frame their rules, precepts, and instruments, with regard of the Variation, as herein I haue shewed, or else ease themselues of that trauaile, for as good none, as vnprofitable.

FINIS.

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Com. Lat 37 05
y^e Lat 52. 55

these Dec. of the ☉ are taken out of gellibrands in the year 1650. for may 31: 1732. his upper Dec. is taken out of this part of the book entituled the regiment for the sea

The Latitude

Aug[st] 23: 1738: Being the Second year after Beginning Observe for the Lat[d] of Lynn

the ☉'s Meridn Alt. = 15: 00
& ☉'s Zenith that day = 07: 48
Mer. Equator. 37: 12
Lat[d] = 52: 48 Lynn

Otherwise. add the zenith distance, and Declin of the day of observation if ill it is between Mar & Sep[r]: but if ill it is between Sep[r]. and Mar = & the Declination from the zenith Distance the remainder is the Lat of the place: —

for example. in the observation above y[e] meridian altitude = 45: 00. therefore the zenith distance the same, and the sums Decl : 48: which added together is 52: 48. the Lat Sought. but find the observation was made on Dec[r] 31: and the meridian altitude found 15: 16. and Declination 21: 56: then the zenith Distance would have been 74: 44: and the Declination subtracted from the Latitude is under

the ☉ merd altitude 15: 16:
then the ☉ Zenith Distance 74: 44
the ☉ Declination sub. 21: 56
Lat[d] 52: 48: Lynn

William: Barlow
Possidet